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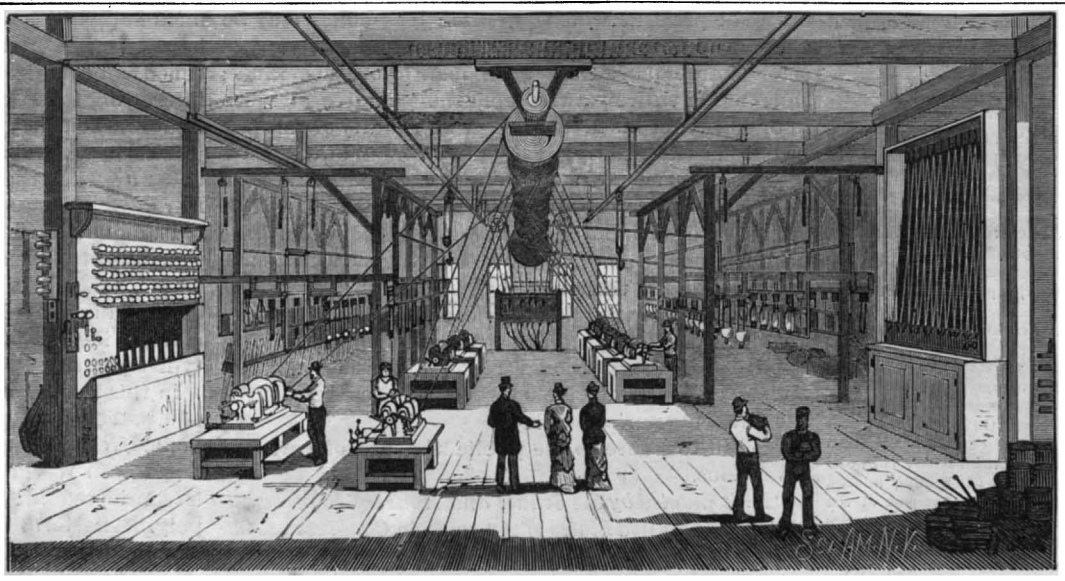
THE BRUSH ELECTRIC WORKS AT CLEVELAND, OHIO.

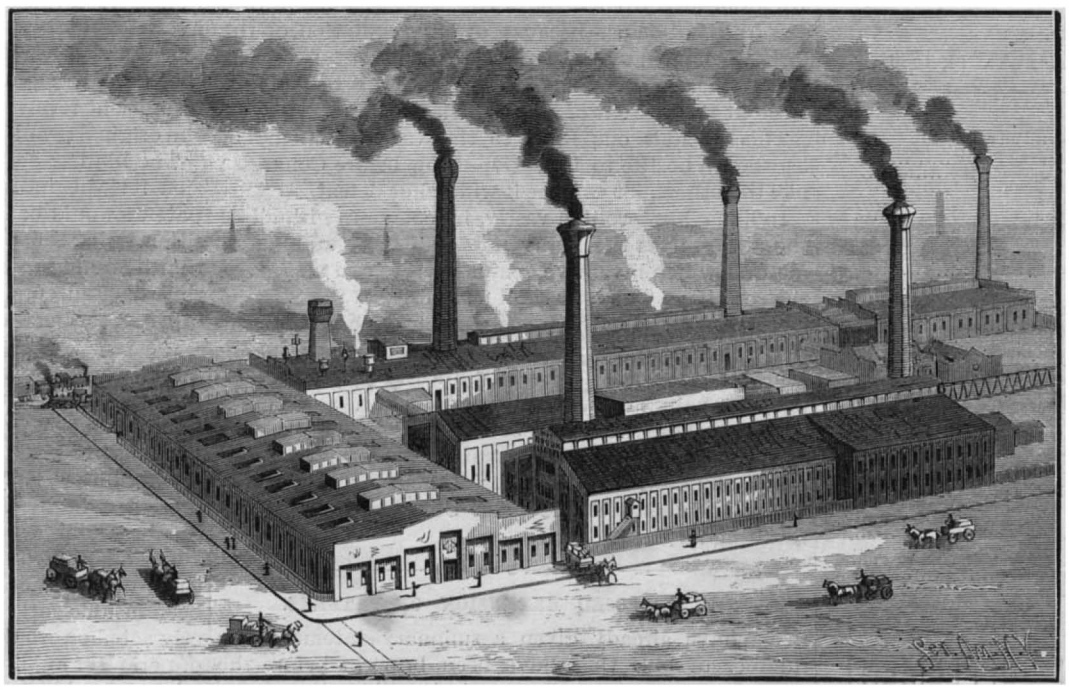
BY H. C. HOVEY.

The remarkable inventions of Mr. Charles F. Brush have been made available and remunerative by the Brush Electric Company, who are the sole owners of all his patents. This combination of inventive genius and business sagacity has, within the last decade, done much to revolutionize the artificial illumination of the world, and built up a business in whose various branches more than $25,000,000 are now invested. The earlier experiments and achievements of this company have already been described. (SCIENTIFIC AMERICAN, April 2, 1881, Nov. 1, 1884; and SUPPLEMENT, No. 274.) My object now is to lay before the public a full account of the works in their present enlarged and highly improved condition.

The entire area occupied by the buildings is about seven acres. The main machine shop is one story high and 265 feet by 122 feet in its dimensions. The "cathedral," so called on account of its peculiar shape, is two and a half stories high, and measures on the ground plan 200 by 100 feet. The power building is 120 by 110 feet; the carbon house, 600 by 62 feet; the pattern room and carpenter shop, 120 by 70 feet; the lumber room, 80 by 50 feet; the coke house, two stories high, 160 by 60 feet; besides the oil room, tin shop, blacksmith shop, stables, etc. There are five tall chimneys, about 125 feet high,



TESTING ROOM.



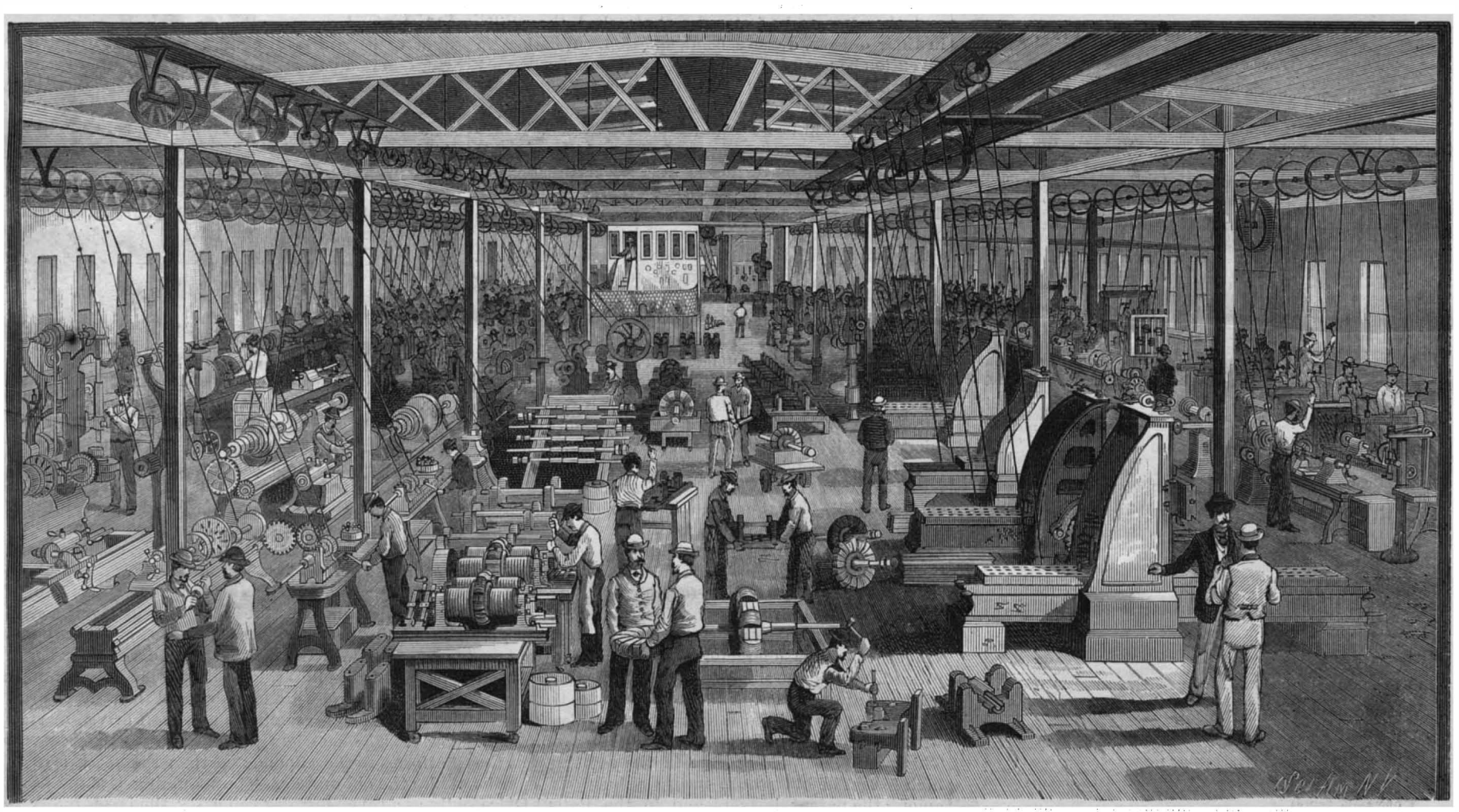
GENERAL VIEW OF MANUFACTORY.

besides several smaller ones. There is an exhibition hall for showing all the styles of lamps, dynamos, electroplating apparatus, electric motors, and other machines constructed here. An incandescence machine in the factory supplies whatever light may be needed, and there is an auxiliary storage battery in the basement, the current for charging which comes from a machine in the factory. This same machine also charges the batteries for several offices in the factory, for the engine room, the armature and magnet department, and the stables.

The main shops are entered from Mason Street, where is also the time keeper's office. Happening to be there at the close of the day, I noticed that each of the 400 workmen who filed through the gate dropped a card into a box provided for the purpose. On inquiry I learned that at the beginning of each day's work every workman is provided, as he enters the factory, with a daily time ticket, on which he records during the day the particular kind of work he is doing and the number of hours he has worked. These tickets are all collected at night, and by this simple system the superintendent readily keeps track of the workmen, and ascertains the exact cost of all repairs and all new work.

In the main shop are manufactured the dynamos, arc lamps, and indeed all other

(*Continued on page* 308)



GENERAL MANUFACTORY OF THE BRUSH ELECTRIC COMPANY, CLEVELAND, OHIO.—INTERIOR OF MAIN MACHINE ROOM.

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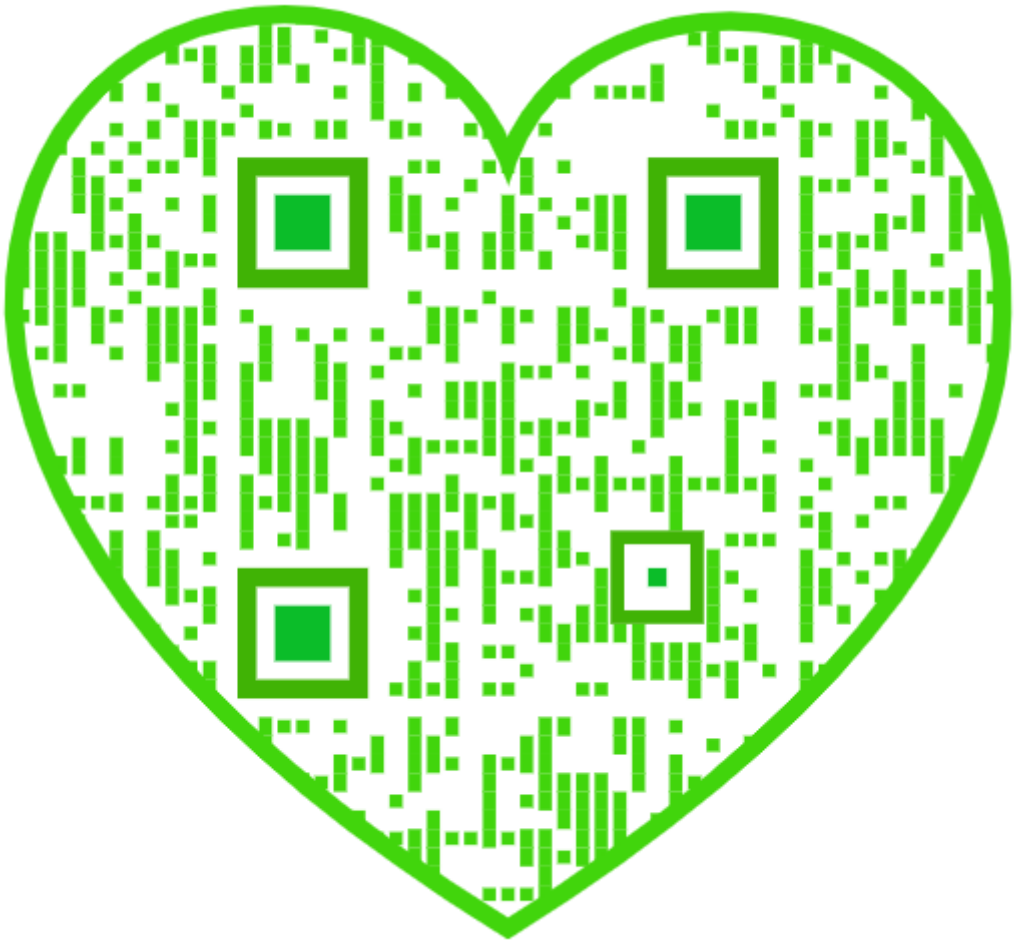

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NEW YORK, SATURDAY, MAY 15, 1886.

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STATE INTERFERENCE WITH PATENTS.

The Supreme Court of the United Statesdecided long ago that all State laws for regulating the sale or disposition of patented inventions were unconstitutional and void, for the reason that the exclusive authority in such matters is by the Constitution exclusively vested in the Congress.

For some unexplained reason, the authorities of the State of Indiana have for years treated the Supreme Court decisions with contempt, and there are to-day among the Indiana statutes several laws relating to patents that are at variance with the paramount authority of the United States. The most recent Indianian effort in this line is the new State law that regulates the price at which patented telephones may be sold. The law specifies that no telephone company shall charge more than $3 a month for use of same; thus taking entirely away from the patentee all voice in or control of his invention. The validity of this law has been sustained by the highest tribunal of the State of Indiana, and is now in force there. The result is that the Bell telephone companies have in several of the cities of the State withdrawn their instruments from use, as the amount allowed by the local law is not sufficient to pay them any profit.

This action of the telephone company has proved so inconvenient to the Indiana law givers that they have applied for Congressional relief, and the Hon. Mr. Holman, Representative of the State, has introduced the following curious bill:

"A bill to secure to the public the use of patented inventions.

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That all persons or corporations, whether owners or licensees of patents granted by the United States, are prohibited from withdrawing any machine or process from public use because of any regulation of the tariff of charges by the Legislature of any State or Territory wherein such machine or process is being used, without the consent of such Legislature."

This bill adds one more to the various schemes of legislation hostile to inventions now before Congress; like the others, let us hope it will suffer defeat.

Indiana has profited vastly, in common with all of the States, from the many new industries and manufactures which inventive genius has created and given the country. The industrial prosperity of the State is largely based upon the wealth which has been brought in to her by the use of new improvements and inventions. If they are to be withdrawn or discouraged, property values must necessarily decline, and manufacturing industries must be removed to more congenial places. With a strange inconsistency, the Indianians, by their own laws, deal themselves injurious blows, and then seek the aid of Congress to avert the resulting mischief.

THE PROPOSED EXTENSION OF PATENTS.

We have already given a summary statement of a number of bills that have been brought before the present Congress for the practical nullification of patents. As patents are a source of wealth to the country, and therefore to be fostered, not attacked, these bills, in their objects, deserve condemnation. Whether an invention be regarded as a property *per se*, or as only acquiring that status after patenting, the simple material interest of the Government requires that inventors should be encouraged, not repressed. Hence it is a matter of some interest to find a bill presented (H. R. 4,034) that on its face at least seems designed to protect, not assail, the inventor. In this sense it is a decided novelty; but it only goes a certain distance on the right way, but not far enough.

The bill applies to all patents ever issued, or issued and extended, or reissued, expired or unexpired. On application, the Commissioner of Patents is authorized to extend them for an additional period of eight years. Such extension is not to confer the right to damages for any infringement committed between the expiration of the original patent and its renewal. The interested party, who may be inventor, or administrator, or executor, must prove the value of the invention, and show what profit it yielded such party or parties. Publication in the District papers and elsewhere of the proposed extension is provided for. Should the patent be shown eligible for extension, a total fee of twelve hundred dollars is to be paid. Two hundred is a preliminary fee, to be paid before publication; one thousand dollars is the final fee, to be paid before issue.

On its face, as providing for the possible extension of all patents ever granted, this bill might appear revolutionary. But it is hedged in with so many provisions that this character is to a great extent repressed. Thus, the size of the fee required would cut off many applications. All expired patents that are to be renewed under it must have their application filed within six months of the date of the passage of the bill. This provision would operate in the same way as the high fee. The bill would insure a busy six months among the patent lawyers and in the Patent Office. The amount of applications that would be filed in that period would exceed all precedent. Many a device, duly patented, that yielded the patentee a very poor return for his ingenuity, has now, as the basis of improvements, mounted into great importance. Many of the early patents covering the modern straw cutter, the plow, washing machine, churn, sewing machine, mower and reaper, the planing machine, the vulcanized India rubber, the telegraph, and hundreds of other great inventions, would certainly claim the new lease of life. The amount of revenue to be derived from some of these patents, if revived and extended at this day, would be simply fabulous.

Not only would this bill benefit some of the early inventors. The patent lawyers in the new infringement suits which it would occasion would reap a rich harvest. The circuit courts would have more of their time than ever devoted to patent cases. It would be interesting to see how the old patents would now be treated when they reached the Supreme Court. There would be a probability of more rigid construction being awarded their claims than they received in former days.

The limited time within which application under this bill is to be made would prevent many extensions. But all unexpired paying patents would certainly be extended under it if allowed. In other words, the terms of many important patents would be extended to twenty-five years.

In this there would seem little objection. The award of a patent right is by the best authorities considered a bonus from the Government. Property in ideas has never been recognized. All protection accorded them is considered artificial, and in the nature of a monopoly. The term of a patent is the measure of the bonus. Otherwise, as a matter of simple justice, patents should be awarded for all time, and the Patent Office would become a simple office of registry. A twenty-five years' term would not from this standpoint seem too great a reward, especially when it is remembered that the last eight years would be conditional on an insufficient return having been yielded by the term of the original grant.

The bill has a great deal of good in it. Any provision for the indiscriminate extension of all expired patents would be so revolutionary as to deserve opposition. But the present bill has so many limitations that it would not seem destined to do any harm in this regard. Indeed, it may be considered to err in the other direction.

If expired patents are only to have a limited time for securing their extension, six months does not seem enough. The amount of the fee is quite disproportionate to the prevailing rates of the Office. These two features give the bill a disagreeable aspect, as, to say the least, they suggest the possibility of its being presented in the interest of some particular corporation or patentee.

The one and only restriction needed is contained in the provision that the applicant must show that he has been insufficiently rewarded for his work. This properly acted on would suffice. No high fee or restriction of period of application is proper.

In such a bill as this, it would be well to insert some special clause relating to extension of claims. Many an old patent of greatest merit would be useless on account of its restricted claims. If justice dictated the extension of a patent, the same quality would suggest the propriety of seeing that its claims were made to cover the essential features of the device, and its points of novelty judged by the state of the art at the period of its original date of issue. The scope of the claims might justly be determined in the extension proceedings. The present treatment of expanded claims of reissues by the Supreme Court is a subject of general criticism among patent lawyers.

New Process of Manufacturing Car Wheels.

At the works of the Dickson Manufacturing Co., in Wilkesbarre, a new machine and process, patented by J. J. Carr, has been tested with satisfactory results. It is claimed that while on the old method of moulding, casting, dressing, and boring the wheels the average product of three men per day of twelve hours is eighteen wheels, with the new process the same number of men can turn out one perfect wheel every minute, or 720 wheels per day. The principal feature seems to be the substitution of a steel core for one of sand in casting the wheel. This has been tried before, but no one had hit upon a means of getting this core out of the wheel after it was cast. This is now accomplished by a center key, which falls out upon a single stroke of the hammer and lets the steel core drop out, leaving the hole in the wheel perfectly true, and ready to be put upon the axle without any dressing or boring. The sand is run into the moulding boxes by a hopper, and both matrices are moulded and the pattern drawn out by the single revolution of a shaft driven by steam power. The matrices are borne away upon movable platforms to the cupola, and then the piece is cast as under the old process. The moulding is done as rapidly as a revolving disk can carry the boxes under the pressers.

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Nutritious Baking Powders.

BY PROF. CHAS. A. DOREMUS, ADJUNCT PROF. CHEMISTRY AND TOXICOLOGY, BELLEVUE HOSPITAL MEDICAL COLLEGE, NEW YORK.

The public has been educated in the last few years to regard the quality of bread from other standpoints than that of whiteness solely. Greater perfection in the cooking of breadstuffs is now demanded than any other single article of diet.

Next to a fine flour, the quality of a loaf depends more upon the method adopted to give the bread a porous nature than upon any other single element in its manufacture.

The lightness or porosity of bread, as well as that of all varieties of crackers, biscuits, pastry, and the like, is the result of the expansion of one or more gases in the dough. This expansion is generally effected by heat, but may be the result of relieving the gas or gases of the atmospheric or artificial pressure to which the dough is subjected.

In 1856, we have the first suggestion of a solid inorganic acid or acid salt to take the place of the tartaric or citric acid hitherto employed. The suggestion came after a mature consideration of the subject, and was based upon an extensive experimental research. It marked a new departure in the art of bread making. It opened a series of investigations on the whole subject of bread making, which, though controversial in their character, added greatly to our knowledge of this art in all its details, and was the cause of extensive researches being made in cognate fields of science.

On April 22, 1856, Prof. E. N. Horsford secured his letters patent for the manufacture and use of an acid phosphate of lime to be incorporated with starch and bicarbonate of soda, and thus serve as a baking powder. This is the first instance in which, besides acting as an aerating agent, a baking powder was to add nutritive elements to the bread. Phosphatic powders are to-day the sole exemplification of this important principle. The natural phosphates removed from the grain in the process of bolting the flour are, by Horsford's method, restored through the baking powder. While the residues which all baking powders leave, except those which consist of salts which volatilize completely under the heat of the baking oven, are of a nature which makes it a matter of doubt whether they should be introduced into the system, in the case of the phosphatic powders the residue is of positive value, and is not foreign to the flour, but composed of the same salts, practically, which form the ash of the cereal grains.

It is a serious problem for the physiological chemist to discover the best method of supplying the human system, especially an exhausted one, with the requisite amount of phosphatic food for the organism to remain in health. The phosphatic salts are never wanting in the most nourishing varieties of food, whether vegetable or animal. They are closely allied to all the vital functions, are constantly being eliminated from the body, and must be replaced by a fresh supply. The testimony of thousands goes to show that under the prevalent conditions and habits of American life, there are few who are not greatly benefited when they partake of these same phosphates as restorative agents. The sales of phosphatic preparations for medicinal use, or as a mild tonic, have assumed enormous proportions.

In this connection it may not be amiss to mention the high favor with which the Austrian officials regarded the use of the phosphatic powder for bread making for the army. It was my good fortune to be one of the witnesses of the experiments made by Prof. Horsford before the commission detailed by the Austrian Minister of War, at the Vienna Exhibition of 1873, in which he demonstrated the possibility and great usefulness of phosphatic baking powders for an army in the field. A brief account of these experiments, which proved most successful, was incorporated by Prof. Horsford in his elaborate report to the United States Government, and published by it under the title of "Vienna Bread," but the modesty of the author prevented his giving this part of the subject the notice it deserved.

Elaborate experiments on the effect of the residue left by certain baking powders on gastric digestion showed that the digestion of albumen by gastric juice was greatly retarded by the residue which would be left in biscuit made by cream of tartar baking powders. Besides retarding the digestion of albumen, it was observed that the tartrate residue rendered the mass liable to fermentative changes.

That the phosphates can have any detrimental influence on either gastric or intestinal digestion is improbable, since the juices of the digestive organs contain these salts in relatively large proportion. Indeed, at one time, the acidity of the gastric juice was considered by many to be due to the presence of phosphoric acid in combination. Practically, the "acid phosphate," as prepared by Professor Horsford, has been found to act with great benefit in some types of dyspepsia. While there are many baking powder mixtures of quite dissimilar composition, yet they have essentially but one office, that of raising bread. Their action may take place at the time of kneading or subsequently. They may possess some advantage in regard to cost or quantity to be used; in the residue, if there is any, being either smaller or less injurious than some other; but in all cases, save one, the element of adding a nutritive character to the bread is entirely lacking.

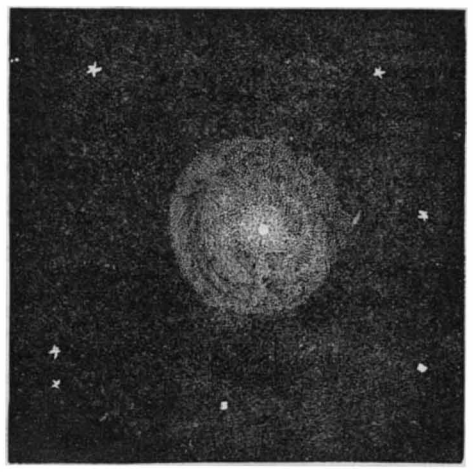
Unless a phosphate form one of the ingredients of a baking powder, there is no residue left of nutritive value.

We are in the position to-day to select from among many of approximately equal value in other respects, a powder which shall, through the foresight of one versed in science, surpass all competitors in possessing the additional quality of restoring or adding to the flour nutritive elements.

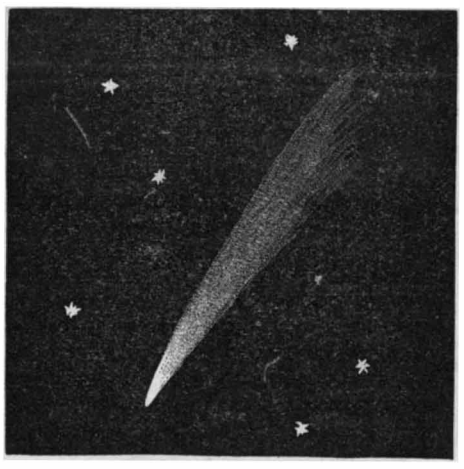
DISCOVERY OF TWO NEW COMETS.

On the evening of April 27, 1886, it was my good fortune to discover the first comet of the present year. It was situated in the constellation Cassiopeia, and in the same low-power field with the star Kappa. Its appearance was that of a large round nebulous body, with slight central condensation and no tail. Its motion was about one degree daily in a southeasterly direction.

Again, on the Saturday morning following, or on May 1, it was my privilege to discover still another



BROOKS' COMET No. 1.—1886.



BROOKS' COMET No. 2.—1886.

TELESCOPIC VIEW ERECTED.

comet. This one was situated in the great square of Pegasus, in the eastern sky. The comet's position at discovery was 23 hours; north declination 21 degrees, with a northerly motion.

It has a small though bright star-like head and a fine tail, indeed, a most beautiful telescopic comet. It very much resembles the great comet of 1858—Donati's—when telescopic. It cannot be that comet, however, for it has a period of 3,000 years.

As a matter of interest and record, and showing the different characteristics of these two comets, which have visited our heavens together, I append drawings of the same. Comet No. 1 is visible the entire night, in the northern heavens, being circumpolar; while No. 2 is visible in the early morning sky. Both comets were discovered with the 9 inch reflector of this observatory, and may be observed with telescopes of half that aperture.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., May 5, 1886.

THE ALADDIN COOKER.

The Honorable Edward Atkinson, of Boston, whose interesting article, entitled "The Price of Life," appeared in the SCIENTIFIC AMERICAN of April 10, writes us that he has received a large number of letters of inquiry concerning the cooker mentioned in the article, and in answer to his correspondents he would like an engraving and description of its construction to appear in these columns. We are glad to oblige Mr. Atkinson, and at the same time we believe the subject will interest many of our readers. The engraving will be found on another page. Mr. Atkinson disclaims any intention of patenting the invention, and wishes the public to have the benefit of it.

Cost of Different Kinds of Walls.

The following, from the *National Builder*, shows the comparative cost of frame, brick, and stone walls.

The first idea that naturally suggests itself, after the general plan of arrangement has been perfected, is what material shall mainly enter into the construction of a building, brick, stone, or wood. In nearly every portion of the Eastern, Middle, and Western States, these three building materials can readily be had, and the cost of production does not vary much in any locality. Assuming, therefore, that the first cost is the same in the above localities, we may easily arrive at the ultimate cost of construction. For the purposes of this article we may assume the cost of good common brick, during the summer to be $8.00 per thousand; cost of labor and mortar to lay the same in the wall, $4.00 per thousand, wall measure. The cost of good quarry stone, assumed at $10 per cord; the cost of labor and mortar to lay the same in the wall, $8 per cord of one hundred feet. The cost of framing lumber $12.00 per thousand feet; labor and nails to put the same up, $6.00 per thousand. With these prices as a basis it is a matter of computation only to arrive at the proportionate cost of each material after it has been worked into the walls. As an example, suppose we have ten feet square of plain wall to build, what will be the comparative cost? Ten feet square equals one hundred superficial feet. If to be built of brick twelve inches thick, estimating 22½ brick to the superficial foot, would take 2,250 brick; cost in wall per thousand, $12.00, equals $27.00.

To lay a good rubble stone wall, it should be 18 inches thick; therefore, 10 feet square, or 100 superficial feet, of stone wall 18 inches thick, at $18 per cord of 100 feet, would cost $27.00. In estimating a frame or studded wall there should be included first, the studding, say, 2 x 8, 12 inch centers; second, the outside sheathing of 1 inch surfaced boards; third, the siding of clear pine. For this example we have placed the cost of rough lumber at $18.00 per thousand, put up. We will assume the cost of the inch surfaced boards for sheathing to be $25.00 per thousand, including labor, nails, and material. Siding at $40.00 per thousand, including lumber, labor, nails, and waste. Ten feet square, or 100 superficial feet, of 2 × 8 studding, at $18.00 per thousand, equals $2.43. The same surface, covered with surfaced boards at $25.00 per thousand, costs $2.50; 125 superficial feet of siding, at $40.00 per thousand, equals $5.00, allowing one-quarter for lap and waste. Thus we find the total cost of the frame wall to be $9.93. Add to this the cost of painting the same, one square, at $3.00, we find the cost to be $12.93. Comparatively, therefore, we find the cost of 100 superficial feet of wall built of the three leading building materials of the country as follows:

Common brick	$27.00
Rubble stone	27.00
Frame	12.93

The cost of window and door frames, cornices, etc., may be estimated about the same in either building. In brick and stone buildings we find the additional cost of cut stone window and door sills, water table, etc., but the cost of these adjuncts does not enter into the first cost of the walls, and should rather be estimated on separately or considered as additional items of cost that may be dispensed with if necessary.

The May Comets.

Early in December two comets were recorded, which were named from their discoverers Comet Fabry and Comet Barnard, and which gave promise of becoming much brighter than the ordinary telescopic comet.

From the tables of position published by the Berlin Observatory, it seemed probable that at the time of greatest brilliancy, during the first week in May, both comets would be visible to the naked eye, high up in the northwest and early in the evening. They have, however, failed to realize these anticipations; they certainly have not become the promised "conspicuous objects," and it is, indeed, extremely doubtful whether they have anywhere been seen without the aid of a telescope. Unless there should be some sudden and unexpected increase of brilliancy during the coming week, both Comet Fabry and Comet Barnard will simply add two new names to the long list of telescopic comets.

The two other comets which have been recently discovered in the same general quarter of the sky are as yet remote and undeveloped, and, therefore, of small general interest.

CLEAR SHELLAC VARNISH.—To get an absolutely clear solution of shellac has long been a desideratum, not only with microscopists, but with all others who have occasional need of the medium for cements, etc. It may be prepared by first making an alcoholic solution of shellac in the usual way; a little benzole is then added, and the mixture well shaken. In the course of from twenty-four to forty-eight hours, the fluid will have separated into two distinct layers, an upper alcoholic stratum, perfectly clear, and of a dark red color, while under it is a turbid mixture containing the impurities. The clear solution may be decanted or drawn off with a pipette.—*National Druggist.*

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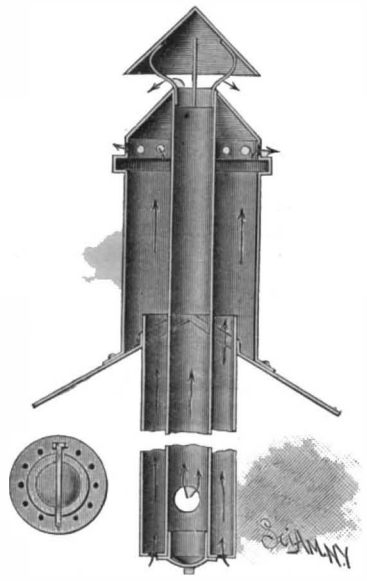
COMBINED CHIMNEY AND VENTILATOR.

The central flue or chimney proper is upheld by an exterior casing provided with a foot plate arranged to be secured to the roof of the building. This foot plate extends inward toward the flue, but does not touch the flue, there being connected to the inner flanges of the plate an incasing tube extending downward and with-



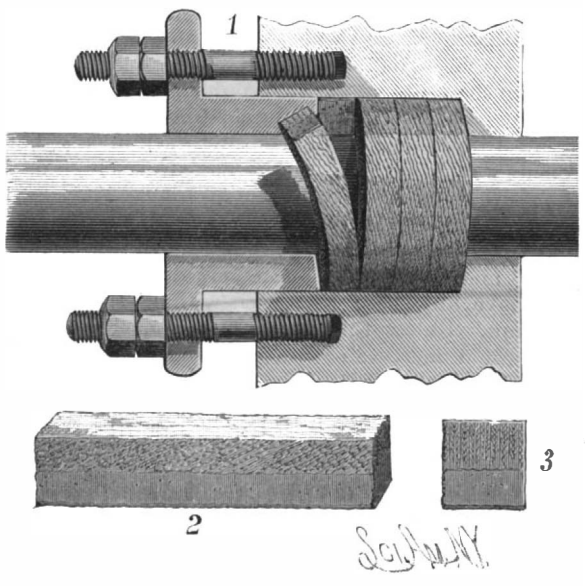
EBERHART'S COMBINED CHIMNEY AND VENTILATOR.

in the apartment where the stove is located. The bottom of the flue is closed by a perforated ring and a soot box held in position by a clasp, while above the flue there is a conical cap. The exterior casing is rectangular and the top is pyramidical. It will be seen that there is a continuous air space reaching from the lower to the upper end of the flue. This space acts as an outlet for the vitiated air of the apartment, which finds an escape through openings in the top of the casing. This current of air, besides ventilating the apartment, prevents any excessive heating of the casing or inclosing tube. The stove pipe is inserted through a hole as shown in the lower part of the cut. This chimney is easily cleaned, and, as its entire weight is supported from the roof, it may be placed in any position desired.

This invention has been patented by Mr. John S. Eberhart, of Laporte City, Iowa.

WHITE RUBBER BACK SQUARE PISTON PACKING.

Anything which will add to the durability and efficiency of the packings used in steam engine cylinders, valves, and stuffing boxes cannot fail to command the earnest attention of engineers and mechanics, and we therefore illustrate a recently patented improvement of the New York Belting and Packing Company in this direction. That part of the packing which comes in contact with the piston rod is made of successive thicknesses of cotton duck, cemented together with an elastic lubricating compound; but a dark rubber has heretofore been used, with which, under the high temperature to which such packings are often subjected, the rubber back loses its elasticity, and fails to act as a spring to keep the packing against the piston rod. The improved packing is designed to overcome this defect by combining with fine Para rubber a special



AN IMPROVED PISTON PACKING.

lubricating compound, capable of withstanding a high degree of heat for a long period. This packing is warranted to stand a temperature of 50° F. higher than the regular dark rubber piston packing, and to endure 300° F. for a long period. It may be applied in separate pieces, as washers, as shown in our illustration, or in a continuous piece with the ends skived off to make a square fit. Figs. 2 and 3 are side and end views of this description of packir the convenience, durability, and satisfactory working of which, even as heretofore furnished, have long made it a favorite with those having charge of the running of steam machinery.

This packing is made only by the New York Belting and Packing Company, No. 16 Park Row, New York city.

Natural Gas for the Cambria Iron Company.

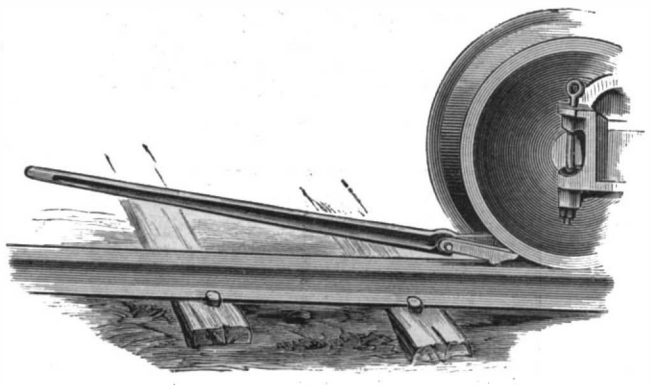
The new natural gas district at Grapeville, Pa., some miles south of the now famous town of Murraysville, promises to be of increasing importance. The second well has been drilled, and affords a larger show of gas than the pioneer boring. Four or five additional wells are being put down, and the future of the district is regarded as assured. A ten inch pipe line has been projected to carry the gas to Johnstown, a distance of about thirty-five miles. It is designed to supply the large iron and steel works of the Cambria Company, and also the 30,000 citizens making up the population of Johnstown and the associated boroughs. About five miles of the line have now been laid, and a large force of men are pushing the work forward. It is probable that the line will be completed some time in August or September.

We are indebted to Mr. John Fulton, M.E., for our information and for the following analysis of the Grapeville gas:

	By Volume.	Heat Units developed by Combustion of 100 Liters.
Hydrogen (H)	7·05	21,866·13
Carbon dioxide (CO_2)	0·58	0·00
Oxygen (O)	0·16	0·00
Ethylene (C_2H_4)	0·17	2,519·82
Carbon monoxide (CO)	0·22	660·00
Marsh gas (CH_4)	35·08	297,548·56
Ethane (C_2H_6)	28·87	447,171·47
Nitrogen (N)	27·87	0·00
	100·00	769,765·98

A COMPOUND LEVER PINCH BAR FOR MOVING CARS.

The bar herewith illustrated has a short lifting arm or nose adapted to bear with its sharp or edged end against the face of the car wheel, with a pivoted ful-



SHELDON'S COMPOUND LEVER PINCH BAR.

crum portion made bifurcated and straddling the lower end of the handle and the other nose, so as to rest on the top of the rail. The fulcrum is formed by a removable bar of steel inserted in a socket in the under side of the pivoted portion, and the noses of the two portions that come in contact with the wheel are also removable, and formed of the best tool steel, casehardened, so they can be changed to use all edges, and when worn out can be replaced by new ones at a trifling cost. It will thus be seen that the bar works on the wheel in two places, the lower nose exerting principally a lifting action, while the upper one tends to turn the wheel, so by the joint action of both the wheel is moved with facility and with greater speed, by a less application of power, than with ordinary pinch bars. This bar will work on a frosty track without trouble; and, although the patent therefor was issued only about three months ago, it is already meeting with an active demand, especially from tanners, foundrymen, mill owners, and manufacturers generally who have occasion to load freight direct into cars on side tracks leading to their establishments, some testimonials of representative houses of this class speaking very highly of its efficiency.

This invention has been patented by Mr. Mark A. Sheldon, whose address is Corry, Pa. Further particulars will be found in our business and personal column.

Steamboats Wanted.

On the northern shore of that beautiful body of water just back of New Orleans known as Lake Pontchartrain lies the Parish of Saint Tammany. It is noted among the parishes of Louisiana for its healthfulness, much of the land being fully a hundred feet above the level of the lake. The country is gently undulating and contains a number of mineral springs, some of which, such as those at Abita, have become noted places of resort. The present steamers, running at the rate of only eight miles an hour, have refused to carry the mails daily to Covington, a distance of 45 miles from New Orleans, for $4,800 per annum. It is believed that a good, swift service would build up this section into a charming suburb of New Orleans.

PRESSURE GAUGE.

The pointer is mounted on the end of a shaft carrying a pinion engaging with a segmental pivoted rack formed with an arm to which is pivoted the lower end of a rod, whose other end is pivoted to one end of an angle lever, having a segment shank pivoted to the end of a curved spring tube, having its adjacent ends closed in the usual manner. This shank is formed with a segmental slot, through which are passed two screws into an adjusting plate on the back of the shank. The lower screw serves to clamp and lock the plate in place,

KUNKLE'S PRESSURE GAUGE.

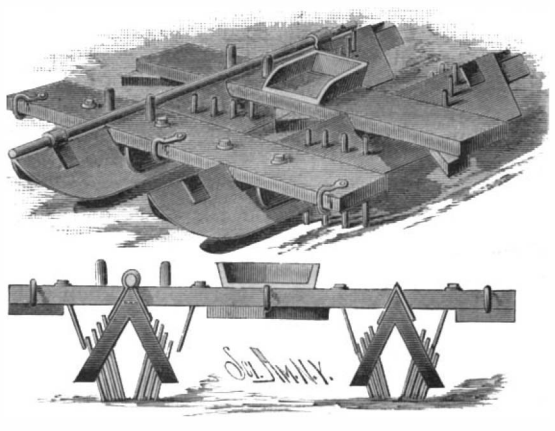
and the other serves as a pivot for one end of a rod pivoted to the opposite end of the spring tube. When the movement of the pointer over the dial is not quick enough, the plate is raised and then locked in place, and when too rapid the plate is lowered. The plate can be adjusted up or down the full length of the slot without changing the position of the index at its starting point, and at the same time the gauge will be made to run fast or slow, just as required. The gauge can thus be adjusted very easily and rapidly without removing or interfering with the pointer, which is a matter of considerable importance, especially when a number of gauges are to be adjusted.

The spring tube is secured at its center in a tubular neck which is firmly held in the casing. The front edge of the case has an internal screw thread, into which screws the neck of the crystal holding ring; a spring ring holds the crystal or glass in place.

This invention has been patented by Mr. E. B. Kunkle. Further particulars can be had from Messrs. E. B. Kunkle & Co., of Fort Wayne, Ind.

LISTED CORN CULTIVATOR.

The engraving represents a light and durable cultivator, the invention of Mr. A. I. McCandless, of Vining, Kansas, adapted for cultivating listed corn for the first, and possibly the second, time. One of the two troughs is rigidly connected to the cross bars, while the other is movably connected. Mounted in the sides of the troughs are steel pins arranged in sets; the pins in the forward set are placed in lines converging toward the front, while the others converge toward the rear. All the pins project about two and a half inches below the level of the bottom of the troughs, and all are at a slight angle toward the rear. The forward cross bar carries a half moon cutter at each side of each trough. The movable trough can be moved outward or inward between limit pins, its upper edge being formed with recesses, through which the cross bars pass, and being provided with metal straps encircling a rod arranged above the cross bars, as shown in



McCANDLESS' LISTED CORN CULTIVATOR.

the upper view. Upon the under side of the rear cross bar are arranged four stops. The front cross bar has three clevises, so that the device can be drawn by one, two, or three horses. In use, this cultivator will be found to bring down the loose earth to the corn, without covering it up, and all weeds on the slopes will be cut down by the cutters. The slight play given to one trough enables it to follow any irregularities there may be in the laying out of the rows.

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Boiler Iron Shovels.

A Shanghai paper states that a novel branch of industry has recently sprung up at Chefoo. It is the manufacture of iron shovels. They are made from old boiler tubes. Hundreds of men and boys are now engaged in this business. The old tubes are cut into short cylinders, just the length of the shovel, and then ripped open, flattened out, and hammered into shape. Piles of these old boiler tubes may be seen everywhere in the back courts of the native Hongs. Mule loads of these shovels are to be seen every day going into the country, and I learn that for one or two hundred miles in the country there is now scarcely a farmer that has not an iron shovel. The prices vary from 25 to 40 cents apiece according to quality, thus bringing this useful instrument within reach of all.

POWERFUL AUTOMATIC CAR COUPLER.

The drawhead is secured to the car in any suitable manner, and, is formed of the front and rear walls, B B', properly bolted together. Sliding laterally between these walls are the jaws, C C, which have noses at their inner ends and are pressed toward each other by springs, D, encircling guide rods which pass through openings in the sides of the drawhead. The guide rods are operated by chains leading to levers mounted on the cars, so that the jaws can be moved in opposite directions, thereby separating them for uncoupling. This construction is designed particularly for freight cars, because the jaws are not locked when coupled, and a slack is obtained between the cars.

For heavy passenger and parlor coaches, the jaws are formed with lugs, L, projecting through slots in the rear walls of the drawhead; attached to the lugs are chains, F, or preferably rods, operated by levers from above, which lock the jaws when the cars are coupled and withdraw the jaws for uncoupling. When the cars approach each other, the pointed, conical, or spear shaped coupling bar, J, enters the drawhead between the jaws, forcing them apart. When the shoulder of the head has cleared the back of the jaws, the springs force the noses of the jaws toward each other, causing them to take firm hold of the head of the coupling bar. In order to adapt the coupling bar for use with old style couplers, it has a hole at each end to receive the pin and a slot to receive the link. At about the center of the bar is a shoulder, M, made long enough to span the drawhead opening, so that when the cars approach each other it will control the extent of the entrance of the bar into the head.

The inventor of this coupling claims that the coupling bar is equal in strength to the drawhead, thereby doing away with the weak link between the cars, and preventing them from separating in case of derailment. The shoulder, M, also acts as a safeguard by controlling the lateral movement of the cars. It is further claimed that the cars cannot mount, overturn, or separate from each other, and that there is uniform strength throughout the train to resist the shock of collision. This coupler can be adapted for use with varying heights of drawheads, and dispenses with all lever links and pins.

The inventor of this coupling, Mr. D. B. Gray, whose address is Germantown, Philadelphia, Pa., will furnish all further particulars; or Mr. John A. Wiedersheim, attorney, Record Building, Philadelphia, Pa.

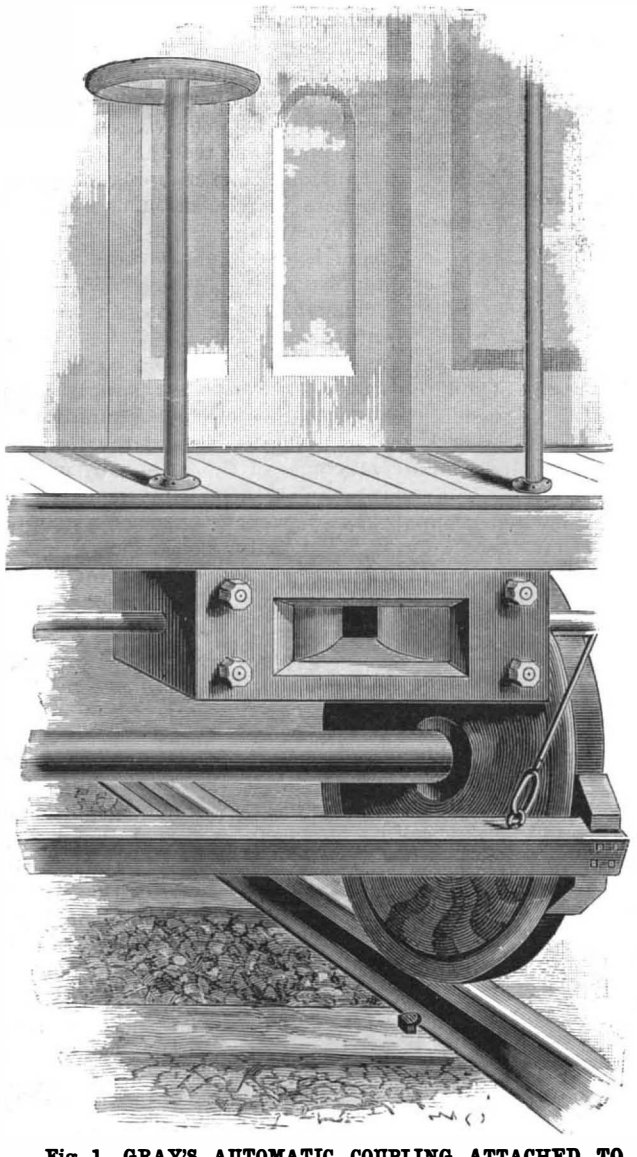
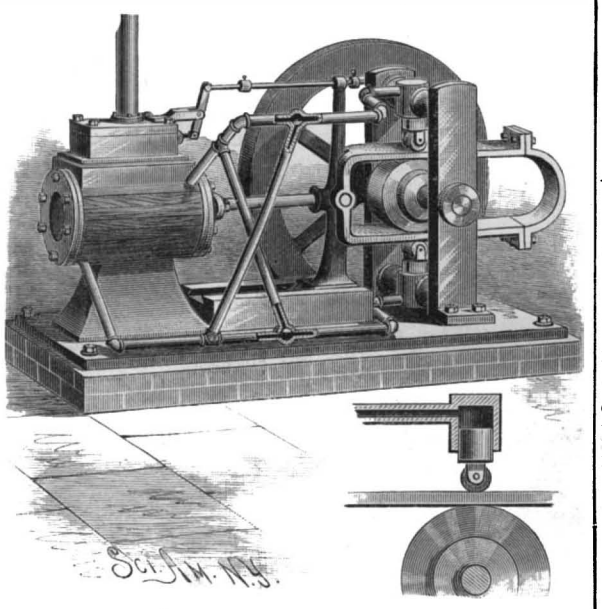


Fig. 1.—GRAY'S AUTOMATIC COUPLING ATTACHED TO PASSENGER CAR.

THE greatest length of Lake Superior is 335 miles; its greatest breadth is 160 miles; mean depth, 688 feet; elevation, 627 feet; area, 82,000 square miles.

A NOVEL STEAM ENGINE.

This steam engine is so designed that the reciprocating motion of the piston is converted into rotary motion without the use of a crank or of racks and pinions. It also obtains a uniform leverage throughout the entire stroke, thereby avoiding loss of power due to use of the crank. A yoke carried by the piston rod is so arranged as to alternately engage opposite sides of a friction wheel mounted on the main shaft. On each side, above and below this wheel, is a small cylinder whose piston rod carries at its outer end a friction roller. These pistons are actuated by steam led from the main cylinder through suitably arranged pipes so as to alternately press the upper and lower rollers against the side bars of the yoke, which pass between the rollers and friction wheel. Steam admitted to the forward end of the main cylinder not only acts upon the piston to force it back, but simultaneously acts upon the small upper piston, whose roller is forced against the upper yoke bar, which is pressed into frictional contact with the upper surface of the wheel, which is caused to rotate. The greater the steam pressure in the main cylinder, the greater will be the pressure upon the bar. When the main piston has completed its rearward stroke, a tappet shifts the slide valve so that steam is exhausted from the forward end of the cylinder and admitted to the rear end. This shifts the small upper piston, and causes the lower piston to bring the yoke bar into contact with the wheel, whose motion is continued in the same direction. To reverse the engine, the steam entering the forward end of the main cylinder is conducted by a cross pipe so as to act upon the lower small piston; a similar cross pipe leads the steam from the rear end of the cylinder to the small upper cylinder. At the junction of the cross pipes with the main pipes there are valves (shown in section in the main view), which can be turned so that steam from either end of the main cylinder can be made to enter either of the small cylinders. The lower cut shows the upper small cylinder in section.



WEBB'S NOVEL STEAM ENGINE.

This invention has been patented by Mr. B. T. Webb, of Beaufort, N. C.

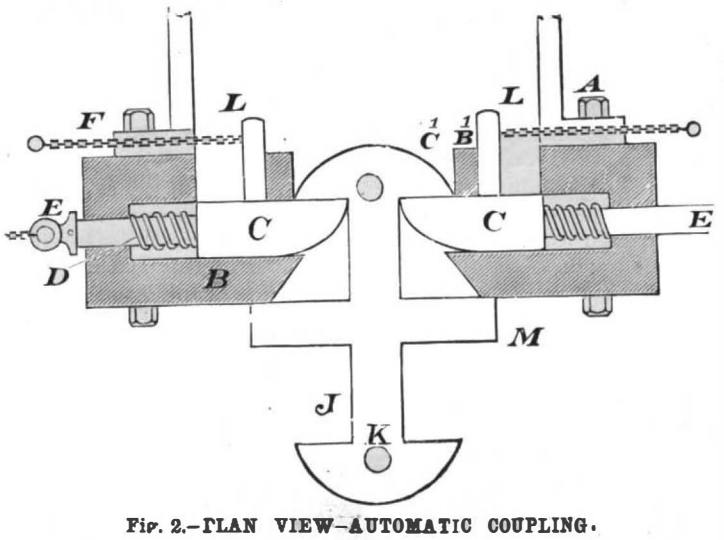


Fig. 2.—PLAN VIEW—AUTOMATIC COUPLING.

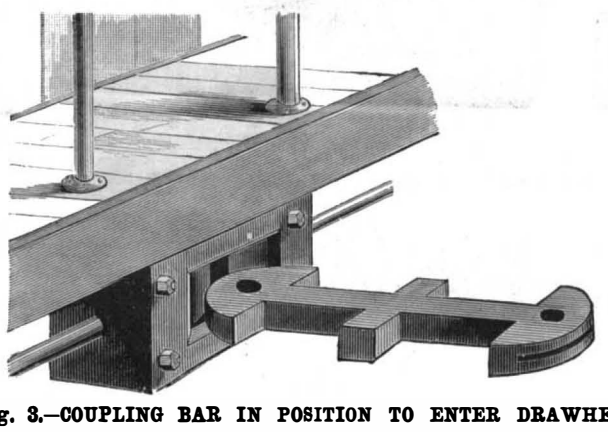


Fig. 3.—COUPLING BAR IN POSITION TO ENTER DRAWHEAD.

Coffee Eating Habit.

A correspondent of the *Medical and Surgical Reporter* mentions the case of a young woman of twenty-two who had acquired the habit of eating roasted coffee beans. Though the habit was only of four months' standing, she had eaten as much as half a pound a day, and had only decreased to 4 ounces per day on the earnest solicitation of friends. The effect on her health had been that she became pale, sallow, and nervous; the pulse weakened, the stomach got out of order, and, among other symptoms, there was marked dyspnœa in going up stairs. An attempt to stop the habit was followed in a few hours by intense nervousness, trembling, and a strong desire for coffee.

The Towers of Silence.

Colonel Floyd-Jones, writing from India to the *Military Service Journal*, gives an interesting description of the "Towers of Silence" near Bombay, and the Parsee mode of disposing of the dead. The Parsee is a devoted fire worshiper, and most of his prayers are offered at morning and evening, facing the sun. It is perhaps in consequence of this belief that he is so careful in preventing the pollution of the other elements, and that after death his body is placed in an open tower, usually on some eminence, where it is devoured by vultures. These open sepulchers have been appropriately named the "Towers of Silence." In every Parsee dwelling house there is an aperture in the upper or sleeping story, which is usually covered by a grating; but when a member of the household dies, his body is placed on a bier and lowered through the aperture to the ground floor, where it is cared for by a set of priests called Neor-ser-sala, or death men, who prepare the body and clothe it entirely in white. Before the body is removed from the house, however, the forehead is smeared with a species of clarified butter, or "ghee," and the dog of the house admitted. Should the animal lick the butter, it is regarded as a good omen of the departed's future happiness, but its refusal would signify perdition. The death men have no contact with the world at large, and on no account are they admitted to the house, as their presence would pollute it. Hence it is that the body is lowered to them, in order to make their entrance unnecessary. A procession is then formed, the friends of the dead following the priests to the Towers of Silence, on Malabar Hill. Arriving at the entrance of the grounds, the body is taken in charge by another set of priests, with long beards, who carry it to whichever of the five towers may be selected by the last set of priests. The body is taken through an aperture in the wall of the tower and deposited on a grating. There are three sets of these, one for men, signifying good deeds, one for women, representing good words, and one for children, indicating good thoughts. The clothing is then removed and torn into pieces, after which it is thrown into another tower and the bodies exposed to the vultures. In a few minutes the birds have stripped all the flesh from the bones. Everything about the grounds is kept as neat as possible, and flowers grow in pretty gardens near the entrance. It is very curious that a religion which otherwise contains so much that is elevating should countenance a mode of burial at once so unnatural and repulsive.

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THE BRUSH ELECTRIC WORKS AT CLEVELAND, OHIO.

(*Continued from first page.*)

apparatus requiring the use of machinery. The castings of all sorts are received at the east end of the shop, the end nearest the general offices, and go through the several departments in order until they reach the west end, near the railroad track, where, in a finished state, they are packed and shipped to all parts of the world. One of the most noticeable features of these shops is the perfection of all the machinery in use. Everything is made of the best material and in the best style of workmanship. The long lines of shafting are bright, clean, and true, suggesting the hand and eye of a master in its erection.

The heavier machines, such as the planers, drill presses, lathes, some of them being very ponderous, are all placed on solid stone foundations. There are cranes, tramways, etc., for handling heavy castings, and transporting machines in the various stages of construction from one part of the shop to another. The motive power that drives the machinery in the main shop consists of one pair of engines, built by William Wright, of Newburg, N. Y., and rated at 300 horse power. The carbon department is run by two "Straight-line" engines of 55 and 65 horse power, the power department is run by a Cummer engine of 450 horse power, and six boilers of 150 horse power each furnish the steam for the above engines.

Beginning at the east end of the shop, let us follow the work through in order. The first thing to be noticed is the manufacture of the armature. This was formerly made of cast iron. But that method was objectionable on account of the cross (Foucault) currents, to avoid which the armature is now made of numerous thin layers of soft hoop iron, the core being laid in a coil, and the other pieces being put on transversely in such a manner as to form openings for the wire bobbins. When the armature has been fitted to its hub, and perfectly balanced, it goes to the winding department, which will be described hereafter. The shafts for the dynamos are all made from open hearth steel (Siemens-Martin) turned and fitted to hardened rings and caliper gauges so exactly as to be interchangeable. As an illustration of this, the company sent a machine to England five years ago, and has just sent to the purchaser a new shaft, which fitted as perfectly as if it had been made for that very machine. The hubs, which are also interchangeable, are usually cast from German silver; though in some recent instances Cowles' aluminum brass has been used with admirable results—a material that has a tensile strength of 95,000 pounds per square inch. The "commutator" is an ingenious device for collecting the currents from the revolving armature. The latter is wound with an even number of coils of wire, the inner end of each being connected by a wire to the inner end of its opposite coil, while the outer ends of all the coils are carried through the hollow shaft of the dynamo and connected with the commutator. The currents thus collected are transmitted by the copper brushes through the field magnets to the binding posts. The commutator, which is attached to and turns with the shaft of the dynamo, is built up from a wooden ring, that is covered with a shell made of the toughest Manila paper wound up with a shellac filling, through which the wire runs to connect with the armature. Outside this paper shell are insulated brass segments, of which there are as many as there are coils on the armature, each set of segments being connected by wires with a corresponding pair of bobbins. Thus each pair has a current passing through it only during three-fourths of a revolution and rests during the remaining quarter, meanwhile keeping its own circuit open by means of its segments. This contrivance greatly increases the efficiency of the dynamo. Copper wearing plates are placed outside the brass segments; and these plates and the brushes are said to be the only parts of the dynamo ever needing repairs. The brushes, as every reader probably knows, are flat strips of elastic copper, two or three inches wide, slit at the ends into eight tongues, which press against the rings of the commutator, one pair above and the other below, and each making contact in such a way that the main circuit is never interrupted.

In the planing department, which is quite extensive, the chairs, magnets, and rails are planed and carefully fitted. They are then tested for softness and quality, and afterward drilled to standard gauges. One end of each magnet is distorted to form a pole piece, and this is grooved to prevent cross currents. Having again been rigidly inspected, the parts of the machine are then set up on dummy shafts and armatures, and once more tested to see if they are in all respects perfect.

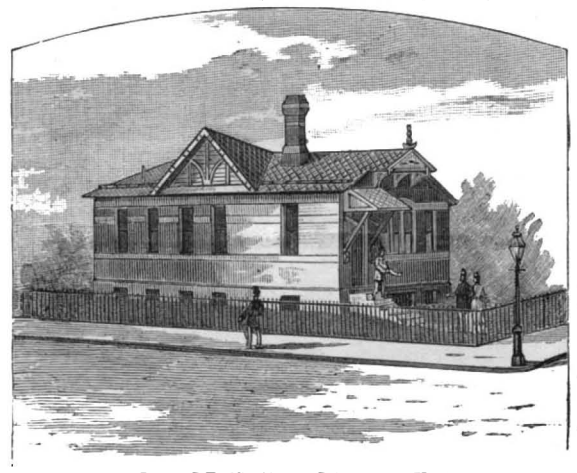
There is a "screw" department, where all sorts of screws for the lamp and dynamo are manufactured by machinery made expressly for this company by Pratt & Whitney.

In the "lamp details" department, all the details of the varieties of lamps made here are manufactured. The parts are made by means of hardened jigs and fitted together with exact nicety. All this

OFFICE.

work undergoes rigid inspection before going to the assembler.

The testing room is provided with a testing rack, switch boards, resistance boards, and other contrivances for testing arc lamps and incandescence lamps. Opposite the main entrance is a brilliant display of arc lights, sometimes as many as one hundred and fifty being tested at once. Each light having 2,000 candle power, it follows that the 150 collectively would have the equivalent of 300,000 candles.



MR. BRUSH'S LABORATORY.

The lamps all swing on a level with the eye, and yet my own experience was that the result of looking steadily at them was not at all painful, as one might suppose would be the case with such a dazzling array. The secret of this is that the pure white light, like daylight, is adapted to the human eye.

In passing among the arc lamps, I noticed groups of incandescence lamps, and learned that these were to test "the multiple series cut-out" lately invented by Mr. Brush, and of which more than 600 are now in successful use. The object of this invention is to enable groups of 4, 7, 14, 28, 32 (or indeed almost any desired number) of small incandescence lamps to be substituted on arc circuits in place of the large single lights with the ordinary 2,000 candle power current. With each group goes a multiple series cut-out box, whose levers may be worked by cords.

The general stock room is centrally located. So also is the superintendent's office, being elevated six feet to enable him to overlook the entire machine shop, and by a system of call bells he can at will summon to him the foreman of any department.

Leaving now the main building, we cross an open passage way and enter a huge structure styled the cathedral. A portion of it is occupied by the factory of the Swan Lamp Manufacturing Company, for making the Swan incandescent lamp.

On entering the long apartment devoted to the winding of armatures and magnets, our attention is first directed to three men whose business it is to wind the wire that is to be used and to examine with the utmost care the insulation. They must see that no splinters occur in the wire, nor breaks in the thread. The consequence of neglect might be that what the workmen call "a nigger" would get into the armature, and burn it so as to destroy its service. The wire, having undergone this inspection, is measured off into suitable lengths for the winding of each bobbin. For some large bobbins, as much as 1,200 feet is required.

The greatest possible care must be taken in winding, to see that the wire is properly put on and that all the bobbins of any given armature are exactly of the same size. All this work has to be done by hand, because it requires such expert manipulation at each step; and for the same reason there are but few men successful in this department, there being only twelve or fifteen in all at the time of my visit. Each armature requires a specific number of convolutions for its successful working; and all calculations as to the length of the wire must be exact to within one one-thousandth of an inch. Too little wire will overheat, and too much will offer too great resistance. In this department the best of materials are used for insulation, consisting of the finer cotton goods, best of canvas, and paper containing the most fiber. Quantities of shellac are spread, as a varnish, on each successive layer of wire. This room also has various ovens for drying the armatures, which must be very thoroughly done. There are, likewise, crimping blocks to form the insulation for the different sizes of armatures. The machinery and tramways for the handling of the heavy parts render the otherwise hard work easy. The dimensions of the armatures vary from nine inches in diameter to twenty-six inches, and very much larger ones are now under contract.

The same care is taken in winding the field magnets as in winding the armatures. The cores are thoroughly insulated by paper and cotton cloth; after which they are swung between centers, and the wire is wound on in layers from a reel that has sufficient tension to make a true job. The crimping machines and drying ovens are here in requisition, as well as in the treatment of the armatures. Some of the machinery used in this room is ponderous, and all must be very exact, and handled with great precision.

The *storage batteries* are also manufactured in the cathedral building. A storage, or secondary, battery makes it possible to have a reservoir of electricity, from which a supply can be obtained when the dynamos are not running. Such a battery can also be located to suit the convenience and economical wishes of the consumer, without reference to the location of the generator.

The battery consists of a number of cells containing lead plates that are cast in a peculiar laminated form, to obtain as much surface as possible. These plates are coated with the peroxide of lead, and immersed in dilute sulphuric acid. The cells may be connected so as to get any desired result as to current or pressure. When the battery is in use, the theory is that, while being charged, the negative side parts with its oxygen, which combines with the positive side; and when the current is discharged this chemical process is reversed.

It is not denied that there is much loss both in charging and discharging; and it is clear that an overcharge would tend to destroy the plates. If carefully and skillfully handled, the storage batteries will do what is promised for them. A large number of them can be placed on one circuit, and charged by dynamos at a time when the latter are not required for running the arc lights. With each battery goes an automatic switch, so arranged that as soon as the former is fully charged it shall be disconnected from the circuit; and when the charge has been drawn down to a given point, the switch brings it into the circuit once more to be recharged. Each battery has a meter that registers the amount of electricity stored. The advantages of the

BRUSH ELECTRIC CO.—ARMATURE AND MAGNET DEPARTMENT.

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storage batteries are apparent, especially for lighting steamers and railway trains. They are in successful operation on the trains of the Pennsylvania Railroad and elsewhere, but are hardly adapted as yet for general use, for the reason that they require such intelligent care.

The carbon building is of great size. Here the carbons are made from retort coke. One crusher reduces the coke to egg size, another to the size of buckwheat. It then runs through burr mills and bolting machines until the whole is reduced to an impalpable powder. It is next conveyed to mixing tanks, where it is mixed with adhesive material, after which it is tumbled in roller tumblers until it is ready to be moulded for use. The pressure on each mould is 300 tons. After being moulded, the carbons are "burned" in a reverberatory furnace a week or more, to expel all moisture. Having been assorted for straightness, and inspected and tested for their burning qualities, they are plated with copper and boxed for shipment. The company at this time is making 50,000 carbons a day.

The company employs four expert pattern makers, who are most of the time engaged on new schemes devised by Mr. Brush. A word is here in place as to Brush's electric motor. It is designed to distribute *power* as well as *light*, and under conditions practically the same. This will be a boon to hundreds of small factories, etc., where steam is now used at a disadvantage. The consumer is to turn on electrical power, whether for a sewing machine or a printing press, or for more ponderous machinery, by merely turning a switch, just as a key is turned for starting the electric light from the same arc circuit. In this manner, also, power is to be transported to a long distance from the dynamo by which it is generated.

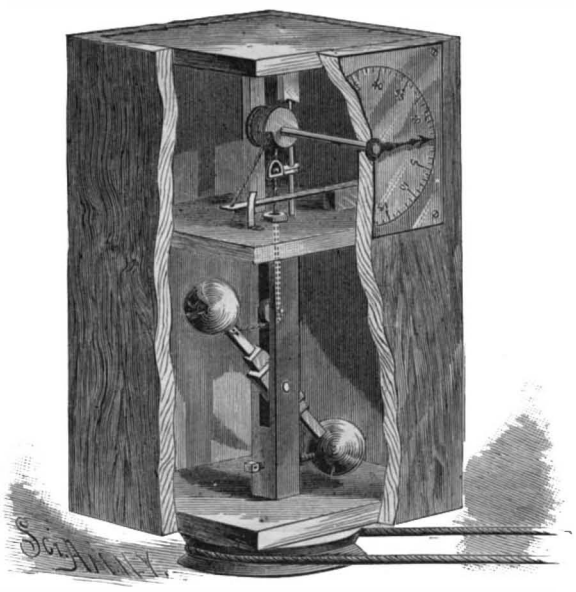
The last building I visited was the "power building." Here are three boilers, of 150 horse power each, and furnishing steam for a large 24 by 48 inch engine. Here is a system of Worthington pumps, Berryman heaters, water tanks, etc. This engine, besides doing other work, drives two great dynamos, the current of which is utilized in the adjacent smelting furnaces of the Cowles Aluminum Company. The smaller one has 600 amperes, and about 50 volts of electromotive force. The larger one is the largest that has thus far been built by the Brush Electric Company. The armature of this great dynamo is 26 inches in diameter, and revolves 907 times a minute, producing a current of 1,575 amperes with an intensity of 46·7 volts. The entire dynamo is 8 feet long and 32 inches wide, weighs about 7,000 pounds, is rated at 125 horse power, and would furnish current for about 1,200 incandescence lamps of 16 c. p. each. Its powerful current is conducted to the furnace room and back by a circuit of thirteen copper wires, each 0·3 inch in diameter, which, as they approach the carbon electrodes, are twisted into a copper cable an inch and a half in diameter. An ampere meter is inserted into this circuit, through whose helix the entire current flows, and on whose dial is indicated the total strength of the current being used at any given moment. A large resistance box also forms part of the circuit, over which passes a heavy copper slide, by means of which the current is readily regulated, enabling the operator to choke off the main flow before breaking it at the switch, thus preventing any serious flashing at the dynamo. Mr. Cowles gave me some astonishing figures as to the practical efficiency of this dynamo in the reduction of refractory ores, and the economical value of the process. The intention is, at an early day, greatly to enlarge their works and remove them to another locality; and in order to accomplish their aims they have contracted with the Brush Electric Company for a new dynamo of immense size, which is now being constructed, and which will be the largest in the world. The machines made on this limited area of seven acres, in the suburbs of Cleveland, have illuminated nearly every city on this continent, and have even been lagely used in other lands than our own. Their brilliant arcs shine in Canada and China, South America and South Africa, Mexico and Madagascar, New Zealand and Australia, India, Egypt, and Japan, and in every kingdom of Europe, and, indeed, have lighted every prominent country of the world.

The officers of the Brush Electric Co. are: President, G. W. Stockly (who is also business manager); Vice-President, J. J. Tracy; Secretary, W. F. Swift; Treasurer, J. Potter; Superintendent, N. S. Possons, and Assistant Superintendent, W. J. Possons, besides a board of directors.

A RESIDENT of Minnesota, who has seen several severe tornadoes, says that their most peculiar feature is the singular sucking movement. Buildings are sucked up into the clouds entire, and come down soon in fragments. After the great Rochester tornado, a farmer twelve miles from town found an uninjured marble top table in his field. Another found a very large sheep that had come from no one knew where and had been deposited in his yard unhurt. The Minnesota man further said that he had seen a board into which wheat straws had been driven until they stuck through on the other side.

CENTRIFUGAL SPEED INDICATOR.

Journaled in a transverse partition and the bottom of the case in which all the parts of the indicator are contained is a shaft, the lower projecting end of which is provided with a pulley. This shaft is slotted to receive a pivoted lever, the arms of which upon opposite sides of the shaft are of equal length and are provided with weights. The journal of the shaft in the partition is made hollow, to receive a rod whose lower end is connected by a cord passing under a pulley hung in the slot with the arm of the lever. The upper end of the rod is attached to a slide moving along a guide rod secured in the casing parallel with the shaft. A cord attached to this slide is wound once around and secured to the drum on the spindle of the indicator. A cord from the free end of a flat spring secured to the partition is attached to the smaller part of a snail secured to the spindle, so that as the cord is wound upon the snail it is received on a continually increasing diameter. A spring, projecting from the partition at right angles to the main spring, bears against the side of the latter with sufficient friction to modify its movement and that of the lever, when the indicator is used for indicating low speeds; but the small spring, being of less length than the distance through which the other moves, the two do not touch during the latter part of the outward excursion of the main spring. Upon the



HERDEN'S CENTRIFUGAL SPEED INDICATOR.

outside of the casing is a dial, in front of which the pointer carried upon the end of the spindle moves. The indicator receives its motion through a belt passing from the machinery whose speed is to be indicated around the pulley. As the shaft revolves, the centrifugal action of the weights tends to bring the lever into position at right angles with the shaft. This action of the weights is opposed by the spring through the connections as described. When the speed is increased, the action of the weights tends to put the spring under greater tension, and by unwinding the cord on the drum and winding the cord on the snail, the spring secures a greater advantage over the weights. When low speeds are indicated, the tendency of the lever to vibrate under the light pull of the spring is opposed by the bearing of the small spring against the side of the other.

This invention has been patented by Mr. Henry Herden, of Wellsboro, Tioga Co., Pa.

What Work Is.

I was riding up town in a Third Avenue car the other day when a butcher's boy, a lad some 14 years of age, in a hickory shirt and with a battered Derby hat on the back of his head, stepped airily upon the back platform and hung his basket on the handle of the brake. He had sandy hair cut close to his head. He was very much freckled, his eyes were pale blue, but keen in their expression, and his nose was of the genus pug. He was smoking a cigarette. For some time he shared the privileges of the platform alone with the conductor, who began talking to the boy about the wrongs of the conductors and their right to strike.

"What are you givin' us?" said the boy; "yer call it hard work to stand out here on the platform and yank a bell? When you ain't doing that, you are inside taking fares, and knockin' 'em down, too. That ain't no work. Jest you begin at 4 o'clock in the morning, like me. Open the shop, sweep it out, clean ice-cold fish out of the refrigerator, and never get no chance to warm yourself; then lug big baskets of meat up to the top of flats all day long, and be cussed by the boss because you don't move round faster. That's work. You fellows have struck it soft, you have. You can't talk to me. I ain't no greenhorn." And he jumped off the car and went down the street whistling "The flowers that bloom in the spring."—*Phil. Record.*

Correspondence.

How to Prevent Anvil Noise.

To the Editor of the Scientific American:

I notice an item in your paper of April 17, on noiseless anvils. It is advised to set in lead or sand. I find by setting the anvil on a piece of plank say two feet square, and hanging that by the corners to the wall above with small ropes, you will get scarcely any noise and no jar, and the anvil is as solid as if placed upon a block. J. L. P.

Owego, N. Y., April 25, 1886.

A Home-made Ash Sifter.

To the Editor of the Scientific American:

I send you this bit of information for the women who, like myself, read the SCIENTIFIC AMERICAN.

To sift cinders, cover your sifter with an old apron or rag. Seize it thus covered, and shake without lifting the edge of the rag.

In case of wind, tread on the edges to keep them down. A few stones applied at the corners will do as well.

I have found the above device a thousand times more practical than any of those cumbersome and dear apparatus which are found in most hardware stores. J. A.

Washington, D. C., May 4, 1886.

A Texan Meteorite.

To the Editor of the Scientific American:

The article on the "New Mass of Meteoric Iron, from Independence County, Arkansas," which appeared some time ago in the SCIENTIFIC AMERICAN, was read with great interest by the officers stationed at this fort.

The appended postscript, requesting readers to communicate through your paper any knowledge they might possess of the existence of masses similar in nature to the one described, and also to report all meteorites that may fall in their vicinity, accompanying their information with specimens, prompted me to send to you a sample of a mass of meteoric iron which I secured while serving in Texas in 1882.

As to the history and manner of discovery of this rare specimen, I will here give it to you as briefly as possible.

On the morning of June 10, 1882, being stationed at Fort Duncan, Maverick County, Texas (a military post situated on the left bank of the Rio Grande), as I was returning to the garrison from a trip in the vicinity, I casually noticed a round bowlder that presented a very metallic appearance. I examined it closely, found it in truth to be a metallic body and a specimen worthy of careful preservation. It being on the land of a Mr. Wieste, I did not remove it at the time I discovered it, but later I persuaded Mr. Wieste to visit with me the place where the mass lay, and inquired if he knew anything concerning it, or of its nature. He stated that "he did not know what it was or where it came from, and if I wanted it, I was welcome to it." It was then that I, for the first time, attempted to lift it, and found it exceedingly heavy for its small bulk. Unlike the plan of the boys who "rigged up a drag of poles and bark" for the removal of the Arkansas 94 pound meteorite, as stated by Mr. Hindman, I had one of the privates (Mr. Brand) of our company carry the mass to our camp. After his task, which was a very tiresome one, was completed, he remarked that "he would not care to carry about with him many such specimens of Texas rocks." I early arrived at the conclusion that the mass was meteoric iron, as it possessed all the characteristics of such bodies.

The photograph which I send to you shows a broad view of the meteorite, and also its resemblance—as expressed here at the camp—to the "shape of a ham."

I have found it to weigh ninety-seven and one-quarter pounds, and to be twelve inches long, ten wide, and six inches thick. Its specific gravity is equal to that of wrought iron, *i. e.*, 7·522. Small pieces cut with a chisel from a pointed and much abraded part of the mass were malleable to a high degree, whether heated or cold.

Like all meteoric irons, this mass is also isometric in crystallization, which is proved by etching a smoothed surface.

Its color when polished is unusually white, more like that of quicksilver; much whiter than is common to meteoric iron.

Owing to the presence of a small percentage of nickel, it has thus far resisted all corrosion or oxidation. A surface of five inches length, which I polished nearly four years ago, remains at this time very free from rust.

The outer surface has the commonly observed black coating, or crust, always found on meteorites.

C. C. CUSICK, U. S. A.

Fort Lyon, Bent County, Colorado.

[We duly received the specimen. It is a very interesting example of meteoric iron.—ED.]

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The Obelisk in Central Park must be Inclosed.

In a paper given in the Transactions of the American Society of Civil Engineers, Prof. Thomas Egleston says: It is expected, now that the obelisk is supposed to have been waterproofed, that the disintegration will cease, but this appears to me to be founded on an altogether mistaken theory, which is, that the cracking is alone due to the expansion of the ice formed in the cracks. The rapid and extreme changes of temperature in this climate in a stone which, from its mass alone, must have but a feeble conducting power, would be sufficient to cause the disintegration already begun, in a stone weakened by exposure to great heat in a dry climate, to continue with comparative rapidity without the intervention of ice, but simply from the continued expansion and contraction going on on its weakened surface. But in a moist climate like our own, where it was subjected to both extremes of heat and cold, it would take place rapidly, as it has done.

As it was a matter of interest to ascertain how far moisture had to do with the cracking under heat, I made the experiment of submitting pieces of granite, which had become quite dry from having been kept housed many years, to as high a heat as could be obtained in the laboratory without melting, and to my surprise found that no spalling or even cracking occurred, although the pieces were subjected to the heat suddenly and for varying periods of time. It is well known that granite in buildings, when subjected to fire, spalls. This is owing to the moisture it contains; to the expansion of gas and liquids contained in microscopic bubbles in the quartz; and to the want of conductivity of the stone itself. Perfectly dry granite does not spall unless exposed very suddenly to a very high temperature. No granite, however, exposed to the weather in this climate is ever dry. Fresh granite contains about one per cent of moisture. That weakened by age, like the surface of all the obelisks, may contain many times that amount, consequently all granites on the outside of structures do spall when exposed to fire. From the fact that the stone of the Central Park obelisk is already weakened and probably full of fissures, which, in this climate, will tend to develop year by year, and from the very fact that the disintegrated stone will absorb more moisture than stone which is fresh, it seems probable that no protection or coating given to the stone will arrest the process of disintegration already commenced in it, if it is left exposed. Even if the surface was entirely waterproofed, the cold of winter and the heat of summer would act below the surface both of the coating and of the stone, causing the coating to break or fissures through it to occur, so as to let in the moisture, and then both causes would operate together as before. But in any case, heat and cold will act altogether independently of moisture, whether the outside be coated or not, and further disintegration must take place under the same circumstances and conditions as that which has already so much weakened the stone. Placing the obelisk in the Central Park, where it is exposed to nearly every agency that could tend to destroy it; allowing the surface of a stone already so much weakened by disintegration to be heated, thus causing further cracks to be made in it; is a greater monument to public indifference and ignorance than the shaft ever was to the dignitary who first erected it or the events chronicled in its hieroglyphics.

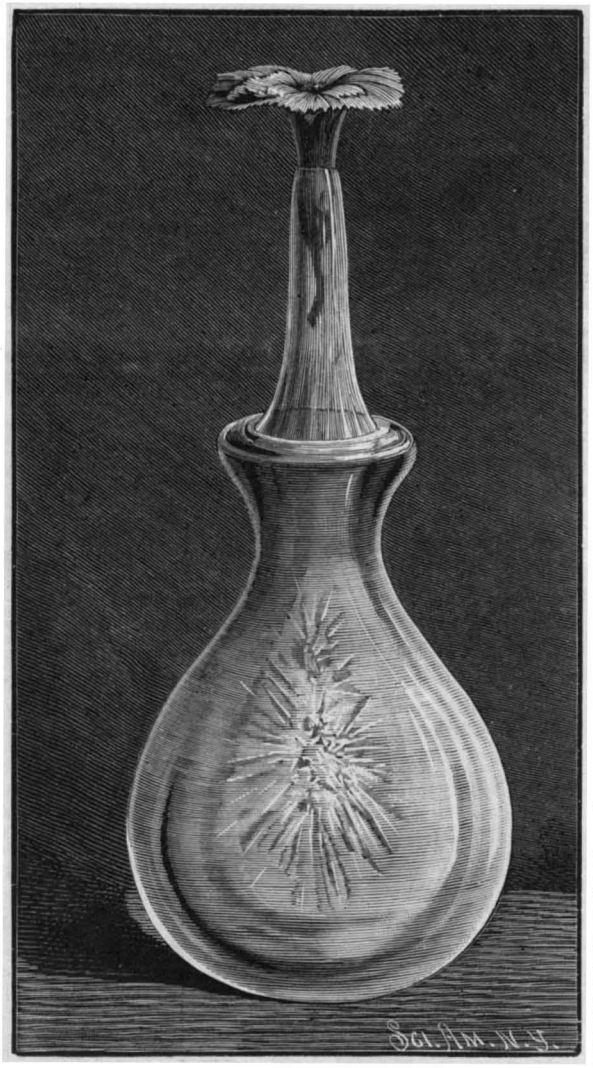
The same dangers, if the reports about it are true, threaten the obelisk on the Thames embankment, although not to the same extent. The climate of England is much less severe than ours, both in winter and in summer. The causes for disintegration, being the same in both cases, will affect the London obelisk less than ours, and there seems to be, so far as any examination of it has been made, no great present danger in leaving it exposed where it is. The obelisk in the Place de la Concorde, in Paris, is reported as cracked all over its surface. Both the European obelisks are therefore in danger of being seriously damaged within the next hundred years. Housing seems to be the only thing left for the obelisk in Central Park.

Fishing with Dynamite.

By special invitation we were permitted to witness a novel experiment one afternoon recently, which was intended to test the efficacy of dynamite bombs in the capture of fish in deep water. The objective point was found to be a hole about twenty-five feet deep in the upper end of the bight, where the fish are known to congregate in large numbers. Arriving at the spot, a cartridge about six inches long, charged with dynamite, to which had been attached a heavy piece of iron in order to make it go to the bottom, was thrown in the water. A suspense of a few seconds ensued, and then a faint report like the discharge of a small pistol was heard, the water became agitated and was raised about two feet, and immediately thereafter, within a radius of about sixty feet, the fish were strewn in all directions. A scene of the wildest excitement followed. Scoop nets were brought into speedy use, and over 1,000 fish of different varieties, from the large gray snapper, over three feet in length, to the small but succulent sailor's choice, were secured.—*Key West Democrat.*

A SINGULAR EFFECT OF THE ACTION OF FROST.

The accompanying illustration represents an ice formation that occurred at a private residence in New York city, in February last. A small vase was left on the bedroom window one night, filled with water, in which was a carnation, and in the morning it was found that the water in freezing had



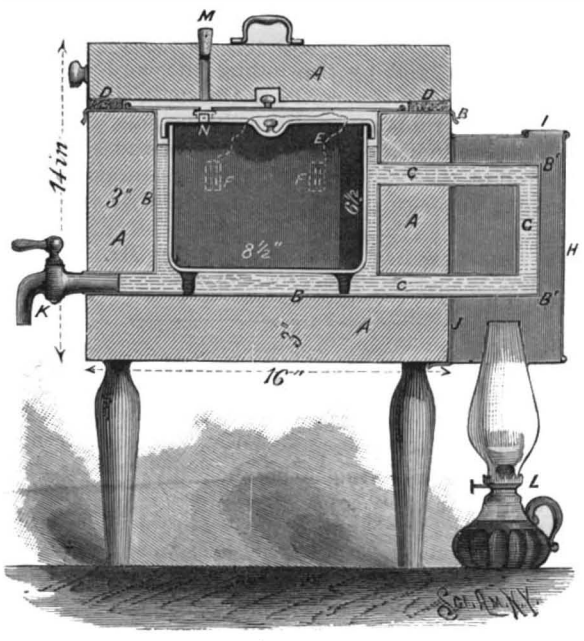
A CURIOUS ICE FORMATION.

raised the flower (which, of course, was wilted by the frost) in a column of ice nearly two inches in height above the mouth of the vase. There was a beautiful crystallization in the center of the vase, but otherwise the ice was clear and solid.

THE ALADDIN COOKER.

BY EDWARD ATKINSON.

The theory of this cooker is to accumulate heat from a common hand lamp inside a pine box, the walls of



A, box made of pine wood, 1½ by 3 inches thick, according to size of cooker; B, lining of tin or tinned copper, fitted with arm, B′, of copper, through which the water, G, circulates and in which it is heated by the lamp, L; the cooking vessel, which may be of metal—preferably of porcelain or of glass. D D, felt lining to cover; E, cord attached to perforated ears or rings, F F; G G G G, water in circulation, heated by lamp, L, to about 200° Fah.; H H, hood of tin around the arm, B′ B′, to concentrate the heat upon it; I, vent to tin hood for draught; J, tin guard to keep heat from wood; K, faucet to draw off water; L, lamp with wick, ½ to 1 inch wide, according to size of cooker; M, orifice for thermometer; N, orifice to cooking vessel, with screw cap, for thermometer; B′ B′, arm, 3 in. by 1 in. deep. Rounded corners desirable inside for convenience in keeping clean. Begin with tepid or cold water if glass vessels are made use of.

which are thick enough to retard radiation, so as to cook such food as may be placed in the cooking chamber or oven, in a thorough manner. All meats, birds, or fish may be thoroughly cooked in their own juices, only a little water being added so as to make a good gravy. Oat meal, corn meal, and farina can be cooked with a suitable quantity of water. Fruit, cheese, and such vegetables as do not require heat above the boiling point, may also be cooked in the apparatus. The juices of meat may be drawn for soup or broth by immersion in cold water in the chamber, before the heat is applied.

If the cooking chamber be 6×4×4½ inches, it will hold about three pounds of meat, which can be well cooked with a half inch wick in about one hour, the water being warm at the beginning. For such a vessel the pine walls need not be over 1½ inches thick.

In a cooking chamber 9×9×10 inches deep, surrounded by a half inch sheet of water in a pine box, of which the walls are 2 inches thick, ducks and grouse have been well cooked in about two hours, mutton in three hours, chickens or small turkeys in about four hours, with a one inch wick, beginning with hot water. A longer time makes meat more tender.

In a cooking chamber 12×12×12 inches, surrounded by a half inch sheet of water, in a box of which the walls are 3 inches thick, 20 to 25 pounds of solid meat can be thoroughly cooked in six to eight hours; a longer time serves for very tough meat. An 18 pound ham or a 20 pound tough old turkey have been made very tender between 10 P. M. and 8 A. M.; 1 inch wick.

In this large cooker the heat of the lamp is more fully saved by the following arrangement: In place of the projecting metallic arm, from which much heat is radiated and lost, the arm connects with a metallic water jacket, surrounding the lamp chimney, which jacket is incased in wood. The same work may be done by jacketing the metal hood, H H, with fossil meal in a wooden case. The meal will protect the wood where it comes near the lamp.

Clear pine appears to be the best non-conductor. Experimenting might be tried with slabs made of wood pulp, which would be less liable to crack or shrink.

The fuel required is about one cent's worth of oil to 20 or 25 pounds of food. This quantity has sufficed for a very old 20 pound turkey, for 22 pounds round of beef, for 20 pounds shoulder of mutton, and for 18 pounds of ham. A very old gander, weighing 12 pounds, was cooked for 15 hours, at a cost of 1½ cents. The meat became so tender that it could not be carved. It was therefore minced.

Several different cooking vessels can be used in the same box. At one time 15 pounds of mutton bouillon, 7 pounds of beef, and 2½ pounds of oat meal with water were cooked a little too much in six and a half hours with one pint of oil.

These are the first crude results. A professed cook may attain much better ones, with greater economy of fuel. The lamp wick should be very carefully trimmed; and in order to avoid smell and smoke from the oil, the flame should not be put up to its full height until a few minutes after it is lighted. The food chamber being practically air tight, there is no loss by evaporation, and no odors of cooking are given off.

The Nation's Health.

The report of Dr. John S. Billings, Surgeon of the United States Army, on the mortality and vital statistics of the United States has been received by the Secretary of the Interior. Dr. Billings divides the country into twenty-one districts, the physical characteristics of which are more or less distinctive. The total population in 1880 was 50,155,783, an increase of 11,597,412 in ten years. Of this increase, 281,219 per annum may be taken as due to immigration, which would make the mean annual increase due to excess of births over deaths, 878,522. The mean annual birth rate for the United States is given at 36 per 1,000. During the census year there was a comparatively low death rate and a high birth rate.

As among the different classes of citizens, the report shows the death rate to have been larger in the colored than in the white population, and among the latter higher in the foreign element than among those of American parentage. The death rate was also greater in cities than in rural districts. The most important causes of disease and death were consumption, pneumonia, diphtheria, typhoid fever, malarial fever, and the various ill-defined forms of attack to which children under one year of age are particularly subject. During 1880, the detachment added to the great army of the dead amounted to 756,893. Of all causes, consumption was the most fatal. Its victims numbered 91,270. By localities, and in proportion to the population, more deaths occurred from consumption at Charleston, S. C.; from pneumonia, at New York; from homicide, at Richmond; and from suicide, at San Francisco.

THE Spanish Government have contracted with Messrs. Yarrow & Co., of Poplar, for the construction of two first-class torpedo boats of the "Falke" type. The speed in fighting trim, carrying 17 tons on board, is guaranteed to be 23 knots, and when running light 25 knots, or about 26¼ and 28½ miles per hour. These are believed to be the highest speeds hitherto contracted for.

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HOW TO CARRY WATER IN A SIEVE.

T. O'CONOR SLOANE, PH.D.

We are accustomed to conceive of liquids as possessing perfect or almost perfect mobility, and as being destitute of cohesion. Within themselves they do possess mobility in a high degree; the molecules are attracted by the molecular forces equally in all directions, so that cohesion is not discernible. But if a very thin layer of liquid is separated from the mass, or even has one side or face exposed, its molecules are no longer attracted equally in all directions, and the force of cohesion appears. An old experiment illustrating this may be cited here. A wine glass with dry edges is filled with water. By proper precautions a number of coins may be dropped into it, the water rising up above the glass to an eighth of an inch or more. (See SUPPLEMENT, No. 232.) In this case the surface film of the

Fig. 1.—EMPTYING CYLINDER.

water by its cohesion and tension holds the water together as would an elastic rubber membrane.

The same phenomenon appears in a pendent drop of water, when we conceive of it as being a mass of fluid contained in a sack or purse of water film. Shot is made by pouring melted lead through a perforated vessel and letting the shower of drops fall through the air until chilled. In this case each drop is drawn into a spherical shape by the tension of the film of liquid lead surrounding it. If a tube of small caliber is immersed for part of its length in water, the fluid will rise within it. Adhesion between the liquid and the glass draws up the edges or periphery of the liquid column only, while the tension and cohesion of the surface film pull up the column, the tendency being to flatten the meniscus or curved upper surface. In this way the fluid rises up some distance in the tube. In the mathematical consideration of the problem, three tensions are generally assumed—water-air, water-glass, and air-glass; but the expression involving the condition of adhesion is preferable where mathematics are not to be used.

Thus, the action of sponges, lamp wicks, and the swelling of dry wood when moistened are due to films almost infinitesimal in area and quite so in thickness, that move through the pores of the solid bodies and draw threads of water after them. Capillary action cannot take place without the existence of a film.

In general terms, the strength and tension of a film are supposed to be due to the molecular attraction of its ultimate particles. These are not attracted equally in all directions for want of an inclosing liquid, so that the attractions which do exist strain the mass together.

Finally, the persistence of so fragile a thing as a film

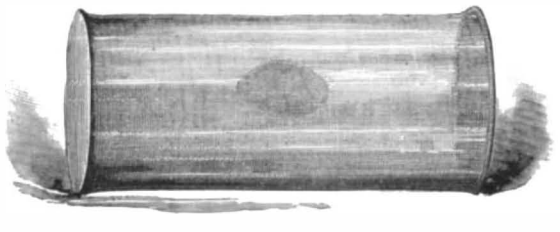

Fig. 2.—EMPTY CYLINDER.

or membrane of water is most striking when its dimensions are reduced. This naturally increases its apparent strength, and makes it have proportionately a more secure hold upon any bounding surface that it adheres to.*

In the cuts, a cylinder adapted to illustrate most strikingly some of the phenomena of capillarity or film action is shown. It is constructed of No. 100 brass wire gauze. Its ends are closed with solid plates or with pieces of the same gauze. Assuming it to be made, the following experiments may be tried with it.

It is immersed in a basin of water, and allowed to remain under the surface until thoroughly wet. This may take several hours with large cylinders; small ones one inch to one and a half in diameter are very quickly moistened. Repeated immersions of short duration sometimes are quite effective. It is now lifted out in a horizontal position. If perfectly wet, it will be completely filled with water. The old problem of the Danaides is solved—a perforated vessel is filled with water; we are carrying water in a sieve. Next the cylinder should be held between the eyes and the light, when its beautiful silky or icy luster will be seen.

The water is retained because the meshes are filled with water film. To empty it, we need only remove some films from their respective meshes. This is most simply done by blowing against the upper surface, Fig. 1, when, as the air is admitted, the water streams out, and in an instant the cylinder is empty. Where the film was blown away, a characteristic spot can be seen, Fig. 2. Now, it can be again immersed, keeping the open meshes uppermost, and it will fill with water. If the meshes had not been blown open, no water would have entered except under considerable pressure. If, after blowing upon the meshes, and while the water is running out, we close the meshes again, it will cease to escape. This can easily be done by shaking the cylinder, so as to dash the water upward and refill the meshes. The outflow immediately stops, and we have a partially filled cylinder, Fig. 3. The question may be asked, Why does not the film at the bottom of the cylinder hold in the water after the upper meshes are blown upon? The reason is simple. As air is admitted above it, the body of the fluid, yielding to gravity, descends and carries the film with it, new water filling the openings in the gauze, until all escapes except what is left to fill the meshes. This action cannot take place at the upper surface, because no water is supplied to keep the meshes full.

If, however, we do this, and pour water on the upper surface when the cylinder is quite or partially full, the water will go through the upper meshes into the cylinder, and escape from the bottom, Fig 4; as soon as we cease pouring, the outflow ceases. In entering, the water is assisted by the suction the column of contained fluid produces. If the cylinder is perfectly empty and perfectly wet, water cannot be poured through it. The lower meshes will not relinquish their films, whose weight is too slight to overcome their adherence to the wire.

These cylinders are most conveniently made on a mould. A wooden cylinder is a good object. The edges of the longitudinal seam are bent over and caught in each other, the mould inserted, and the seam rubbed down with a piece of wood or the back of a penknife. Then the seam is soldered. The ends of the open cylinder are next to be "tinned." This stiffens them, so that they may be bent into true circles. The end pieces, cut out a little larger in diameter, are to be "tinned" around the edges, and then soldered in their places. Solid ends of brass or lead may be used with advantage. Some little trouble may be experienced, as the solder spreads with great facility through the texture by this same capillarity, but a little care will keep the area of the seams within limits. The diameter may be as much as three inches, but the smaller ones are the easiest to use and most certain to work well. It would be advantageous to use rings of sheet brass on the ends to come between the ends and bottoms, but they are not needed, as solder alone will answer.

* For exhaustive series of experiments on films and surface tension, see SUPPLEMENT, Nos. 160 and 495.

Mechanical Properties of Cork.

Mr. William Anderson lately delivered a lecture at the Royal Institution "On New Applications of the Mechanical Properties of Cork to the Arts." The lecturer began by demonstrating experimentally that in solid substances no appreciable change of volume resulted from change of pressure; even India rubber was shown to be extremely rigid. Cork, however, appeared to be a solitary exception to this law, being eminently capable of cubical compression, both from forces applied in opposite directions and from pressure from all sides, such as arose when the substance was immersed in water and subjected to hydraulic pressure. The cause of this anomalous and valuable property of cork was then investigated, and it was shown to arise from its peculiar structure, which rendered it, in many respects, more like a gas than a solid. Cork was composed exclusively of minute closed cells, the walls of which were readily permeated by gases, but were impervious to liquids. The cells were filled with air, which, when pressure was applied, yielded readily, and expanded again when the pressure was removed.

The impermeability of the cells to liquids prevented cork from getting water-logged when exposed to such fluids in bottles and in the new applications devised by the lecturer; and this property, combined with permeability to gases, rendered cork superior to India rubber in waterproof clothing, because it permitted transpiration while excluding the wet. Mr. Anderson next proceeded to explain some of the practical applications which he had made.

The first was the substitution of cork for air in the air vessels of water-raising machinery. This was illustrated by a hydraulic ram, which worked a fountain about 10 feet high in the lecture room. Another application was the storage of a portion of the energy of the recoil of guns, and employing it for the purpose of running them out when ready for firing. The gun carriage was very much like that commonly in use, with hydraulic compressors, but the water in the cylinders was driven by the recoil into a vessel filled with cork, which was thus compressed. The cylinder was separated from the cork vessel by an automatic valve which prevented the reflux of the water. As soon as the gun was loaded, a tap was opened; the cork was then free to expand and liberate the water back into the cylinder, so running out the gun. The lecturer pointed out that

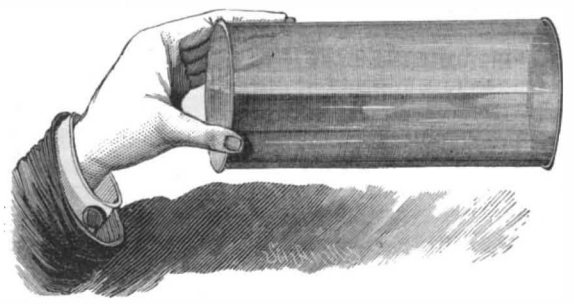

Fig. 3.—CYLINDER PARTIALLY FILLED.

this method of using cork would allow of a gun being run out up any incline. The system was peculiarly adapted for naval use, where inclined planes became inoperative in the event of the vessel having a list in the opposite direction. The lecture, which was profusely illustrated by means of diagrams and experiments, certainly placed cork in a new light before the scientific world, and indicated fresh and extensive fields for its use.

Progress of Marine Engineering.

The steamer Aller, 5,500 tons, 455 feet long by 48 feet broad, was tried on the Clyde recently, and exhibited remarkable results in the matter of economy in coal consumption. The Aller is a distinct advance in speed and economy on account of her triple-expansion engines and boilers. To develop 6,000 indicated horse power in the compound engines, by the same builders, requires a consumption of 130 tons per 24 hours. In these triple-expansion engines the consumption is 90 tons.

A still more remarkable comparison is shown by the results of ocean voyages by experimental engines, from the designs of which those of the Aller have been constructed. It will be remembered that part of the price paid by the Cunard Company for the Umbria and the Etruria was made up of the two steamers Parthia and Batavia, which are now the property of Mr. Pearce, M.P., President of the Fairfield Company. The old compound engines were removed by him to

Fig. 4.—POURING WATER THROUGH FULL CYLINDER.

make room for triple-expansion engines and steel boilers. The log of the Parthia in 1883 shows that she burnt 47 tons of coal per day of 24 hours when going at a speed of 11 knots. Her log during 1885–86 shows that the consumption was 25 tons at the same speed. Her speed is now much higher, but the comparison must be made with her old rate. The Batavia shows still better results. The consumption in 1883 was 40 tons per day at 11 knots. In 1885, with the new engines, it was only 21 tons.—*London Times.*

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Ghosts and Haunted Houses.

In spite of the rigid suppression of everything regarded as superstitious which characterizes the present times, there are a number of traditions and half beliefs which still retain a wonderful vitality. The existence of those apparitions which are popularly supposed to choose the weird hour of midnight for their perambulations, and of those inexplicable manifestations which gain for a dwelling the unenviable name of being haunted, has been affirmed by persons of such undoubted veracity, and believed in by so many of unquestioned intelligence, that a movement has recently started in different parts of the country for the thorough investigation of the reputed phenomena, with a view of deciding whether they have any substantial foundation, or must be accredited to individual mental vagaries.

It must, however, be remembered that it is no argument in favor of their genuineness that these traditions are so universal, for Grimm and other students of comparative philology have shown that many of our best known nursery tales have elements in common with the folk lore of but distantly related people, and with these must be attributed to the ancestral store before the Aryan dispersion. It is unnecessary to say that we do not on this account believe in the existence and sad fortunes of an original Red Riding Hood, or in the exploits of an actual Jack the Giant-killer. And neither can we claim any additional respect for ghosts and similar apparitions because the earliest Aryan mother sent her child to sleep with stories of monsters or fairies, according as the infant had been naughty or good, while later mothers have drawn upon the traditional "man in the dark" to induce obedience. But the present investigators who are taking up this subject have manifested a neutrality which promises most interesting results, should any be reached. They are neither prejudiced by the antiquity of these supernatural entities, nor so far incredulous as to dismiss the whole matter with a contemptuous denial. Viewed thus dispassionately, ghosts and haunted houses form an excellent subject for scientific investigation. At the present time, two cities in particular are holding these popular but still fascinating terrors up to the light of day, and we dare say that in a number of other localities similar societies are investigating their claims to recognition with equal rigor.

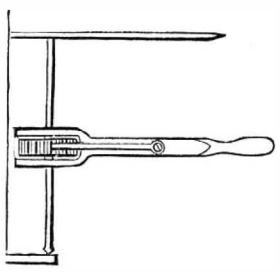
In Boston, the American Society for Psychical Research has appointed a special committee on apparitions and haunted houses. A circular has been issued, inviting communications from those whose experience may enable them to be of assistance in the examination. They desire information, in the first place, regarding reported cases of apparitions of the absent or dead. From time to time, such accounts have been published, giving all the details of the occurrence, and a great deal that would be of immense interest could it be verified. These supernatural appearances are often reported as foretelling future events, usually of a disastrous nature, such as illness or death, and the committee is particularly anxious to acquire all possible testimony in regard to cases where such premonitions have been intelligently recorded and have afterward proved true in whole or part. In addition to these more dramatic spectacles, there is a large class of personal experiences, such as presentiments in connection with material appearances, and the like, which would be of undoubted interest in such an investigation. The testimony of persons who have had these experiences themselves, or have had an opportunity to record the experience of others, is of special value. In making such records, it is important to state the age, occupation, temperament, condition of health, and other personal factors which would be apt to influence the result of such an experience, together with the appearance, circumstances of time and place, duration, etc., of the supposed apparition. It is also of great importance, where any warning is thought to have been conveyed, to know whether it was recorded before verification, in order to give as little play to the imagination as possible. The committee, as we have stated, undertake this investigation without preconceived prejudices. Being very bright people, they cannot help having their own opinions, and it would be safe to say that the majority are without belief in such appearances; but they wish simply to hear and examine the facts, and are pledged to draw from them such conclusions as are warranted by the evidence. They invite the co-operation of persons similarly earnest and unprejudiced. Col. T. W. Higginson, Cambridge, Mass., is one of the committee. A limited time will also be devoted to the personal examination of houses in the neighborhood of Boston which are reported to be haunted.

In Philadelphia, an analogous though less open investigation is now in progress. Some years ago, Mr. Seybert, the donor of the new bell for Independence Hall, was the victim of severe imposition at the hands of several over-thrifty "mediums." At his death he left a sum of money to the University of Pennsylvania on the condition that it should thoroughly investigate the claims of spiritualism, and make the results public. The committee intrusted with the task has been collecting testimony on this point for a number of months, but no results, we believe, have yet been published. It is to be hoped that their labor will shortly be completed and their conclusions made public.

WHO INVENTED THE RATCHET BRACE?

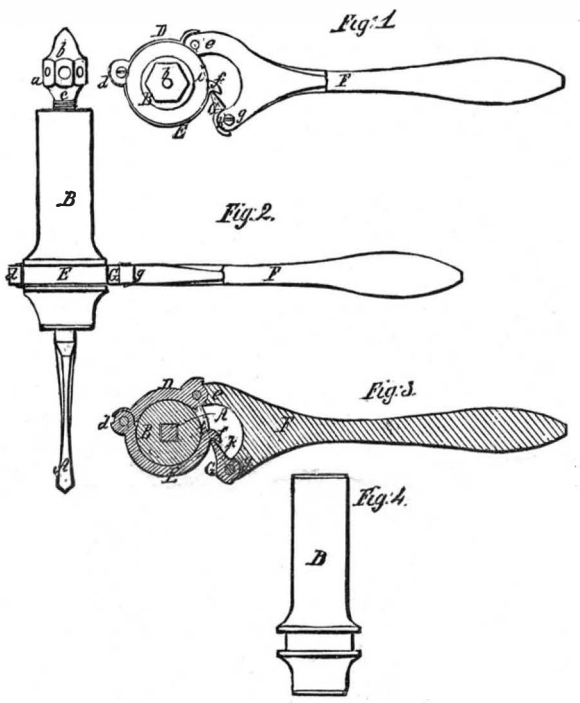
This question is asked in a recent number of the *Engineer*, London, by a correspondent who writes to the editor as follows:

"In the *Mechanics' Magazine* for September 5, 1835, there is a sketch of "a simple drill," said to be the invention of a workman in Mr. Hague's manufactory. Hague was a well known engineer half a century ago, his shops being somewhere near the Tower, I think. I send a reduction of the sketch, and should like to know whether this is the first ratchet brace. The date of the introduction of that useful tool may be within the recollection of some of your older readers, and it may also be possible to preserve the name of the inventor. ENQUIRER.



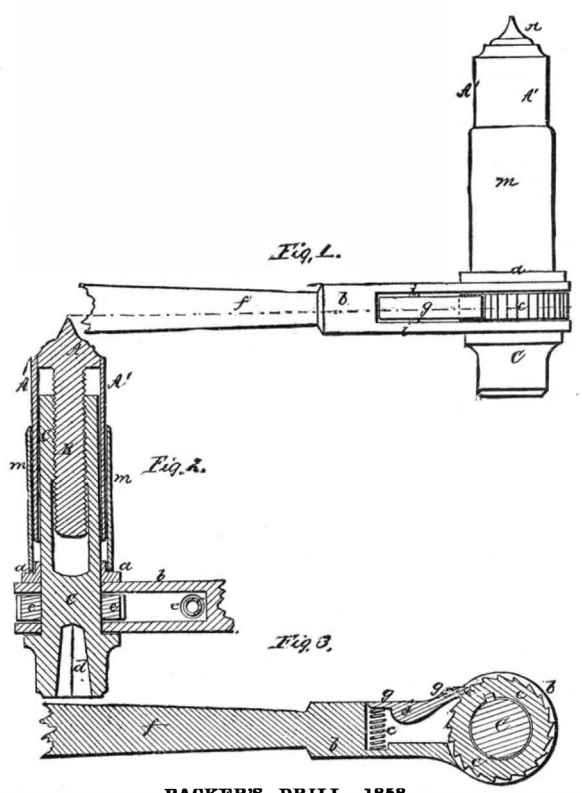
In this country the earliest patents granted on drills of this kind were the following:

John Johnson, of Somerville, Mass., patent No. 5,894, dated October 31, 1848.—A exhibits the drill and B the stock or drill holder. The latter is made with a socket in one end to receive the drill. It has also a screw, C, adapted to the other end, and made to screw in and out of the same, the said screw having a bend, *a*, and a conical projection, *b*, on the upper end of it; the said projection serving for a center to steady the drill. The stock, B, is made with a suitable groove turned around in it to receive two friction bands, D E, which are jointed together, as seen at *d*. The band, D, is jointed to a projecting arm, *e*, of a forked lever, F, while the band, E, has a hooked end against which a small toggle rests and bears. The said toggle is jointed to another or short arm, *g*, of the lever, F, the whole being arranged as shown. The joint of the toggle is so made as to prevent any outward movement of the toggle (that is to say, a movement of it toward the stock) beyond about a right angle to the arm to which it is attached. The said movement, however, when the toggle is borne against the hook, *f*, must be sufficient to allow the two friction bands, D E, to move freely around upon the stock without any bind or friction, such as will cause it to rotate forward with the lever, F, when said lever is moved in a direction away from the person who grasps it. The joint of the toggle should also be constructed in such manner as to allow the toggle to move toward the inner end of the lever. Now, if the drill be placed in position, a movement of the lever toward the operator causes the toggle to so act against the hook of the friction band, E, as to draw or force the two bands, D E, toward one another, and causes them to firmly grasp the drill stock with a degree of friction sufficient to rotate it and the drill with the further movement of the lever. The retraction or reverse movement of the lever will cause the friction bands to unloosen their hold upon the stock, so as to permit the lever to be moved forward to the extent required without creating any corresponding rotation of the drill stock.



JOHNSON'S DRILL, 1848.

Henry H. Packer, of Boston, Mass., patent No. 20,728, dated June 29, 1858.—C is the screw barrel, the upper end of which is bored out and tapered to accommodate the screw, B, the lower end being so constructed as to have formed therein a socket for the reception of a drill. The head of the screw, B, is conical at top, as seen at A, forming a pivot, and has projecting from its perimeter downward a shell, A′, which (when the screw, B, is at its lowest point in the barrel, C) entirely surrounds said barrel its whole length. C′ is a ratchet wheel, which is keyed on to the lower end of the barrel or drill stock, *c*, and rotates in an eye or slot formed in the spindle stock, *b*, for its reception; said ratchet is caused to revolve, carrying with it the band, C, screw, B, and shell, A′, and any tool which may be secured in the shank at *d*. At every half stroke or every other vibration of the spindle stock, *b*, by means of the pawl, *g*, working in a pivot, *i*, and kept in gear with said wheel (at the proper times) by a spiral spring, *e*. The frame or stock, *b*; is furnished with a suitable handle, *f*, on the top of the stock, *b*; and surrounding the barrel, A, is a collar, *a*, from which extends upward a shell, *m*, surrounding the shell, A′, the greater part of its length.



PACKER'S DRILL, 1858.

The operation is nearly similar to those already in use, and requires but little explanation. The whole mechanism is caused to partially rotate at every forward shake or vibration of the handle, F, by means as already described, while at every backward stroke the pawl, *g*, rides over the ratchet wheel, C, leaving the mechanism stationary. When it is desired to feed the drill, the screw, B, is turned by a simple key or lever fitting a hole in its head.

The Great Question of the Day.

The late Dr. Samuel D. Gross, the father of American surgery, used the following words in an address delivered at the dedication of the McDowell monument:

"Young men of America, listen to the voice of one who has grown old in his profession, and who will probably never address you again, as he utters a parting word of advice.

"The great question of the day is not this operation or that, not ovariotomy or lithotomy, or a hip joint amputation, which have reflected so much glory upon American medicine, but preventive medicine, the hygiene of our persons, our dwellings, our streets, in a word, our surroundings, whatever or wherever they may be, whether in city, town, hamlet, or country, and the establishment of efficient town and State boards of health, through whose agency we shall be more able to prevent the origin and fatal effects of what are known as the zymotic or preventable diseases which carry so much woe and sorrow into our families, and often sweep like hurricanes over the earth, destroying millions of human lives in an incredibly short time.

"The day has arrived when the people must be roused to a deeper and more earnest sense of the people's welfare, and suitable measures adopted for the protection as well as for the better development of their physical, moral, and intellectual powers. This is the great problem of the day, the question which you, as the representatives of the rising generation of physicians, should urge, in season and out of season, upon the attention of your fellow citizens; the question which, above and beyond all others, should engage your most serious thoughts, and elicit your most earnest co-operation.

"When this great object shall be attained; when man shall be able to prevent disease, and to reach, with little or no suffering, his threescore years and ten, so graphically described by the Psalmist, then, and not until then, will the world be a paradise."

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ARGUS PEACOCKS IN THE BERLIN ZOOLOGICAL GARDEN.

The Argus peacock (*Argus giganteus*), also called Argus pheasant, was first known in 1780, the first skin of a bird of this species having been carried from Sumatra to Europe about that time. In the first report given of this bird it is stated that "it is a bird of uncommon beauty, perhaps the most beautiful of all." The Argus peacock is of about the same size as our peacock, and, as is the case with most birds, the plumage of the male is much more beautiful than that of the female. Its face is light blue and its bill white; its neck and back are of a golden brown, with light yellow spots shading into yellowish gray, with round brown spots, while underneath the bird is ornamented with lines of brown, yellow, and black. The wings are reddish brown, and the wing and tail feathers are very long. It is impossible to give any idea of the wonderful play of color on these birds; there are white spots on brown regular dark spots on a light ground, and many other variations of color.

The plumage of the female is very plain, and the young have a coat of grayish brown; at first, in fact, they bear a strong resemblance to their mother, to whom they keep very close, even remaining between her feet and moving with her as she moves from place to place.

Most works on natural history lament the fact that these birds soon perish in captivity, but the pair in the Berlin Zoological Garden have proved quite hardy. The Argus plays a conspicuous part in the Malay legends, but, nevertheless, it is highly prized in Sumatra and Borneo as an article of food.—*Illustrirte Zeitung.*

ARGUS PEACOCKS IN THE BERLIN ZOOLOGICAL GARDEN.

Dehorning Cattle.

The subject of removing the horns from cattle has received an unusual amount of attention among stock men within the past few months, on account of the prosecution by the Chicago Humane Society of an Illinois farmer, Mr. Haaff, who has for some years advocated and practiced dehorning cattle of mature age. His process is to confine the animals, and then quickly, with a sharp saw, to take the horns off close up to the head. He claims that the operation is not excessively painful, that it makes the animals less dangerous to each other and their attendants; that considerably less food is required to keep them (the horns calling for much animal heat to keep them warm in a climate like ours); that the cattle, by huddling more closely together in their sheds, are better protected from cold; and lastly, that abortions are far less frequent.

Public opinion seemed at first to be against Mr. Haaff, but as the matter is investigated the farmers are taking a view similar to his. Sawing off the horns is probably less painful, and certainly far less dangerous, than castrating a mature animal, a process that public opinion has sanctioned for centuries. We are aware that there are many dangerous bulls kept by our farmers that would be far less dangerous if they were without horns; indeed, we look upon a horn upon a domestic animal as a nuisance in every case, but we have never as yet either practiced or recommended others to practice the sawing off of horns upon full grown animals.

We once tried to cut out the incipient horns on the head of a calf, but had not the heart to do the work thoroughly, so made a failure of the experiment. We do believe, however, that the removal of the horns from young calves should be a common practice, and that any one with a little experience and courage can take them out effectually, and with very little pain or inconvenience to the animals. And we are glad to learn that so prominent a breeder of fine cattle as Mr. John Brooks, of Princeton, has decided to give the dehorning method a thorough trial upon his calves the coming season.

The horn of a cow is an appendage, not of the skull, but of the skin. In the calf the horn is loose on the head, and may be removed with a section of the skin. The horn is fed by the skin, as is also the hair; and as the removal of the skin on any portion of the body leaves a scar which will not hair over, so the removal of the skin with the rudimentary horn leaves a scar that cannot produce a new horn. It is claimed that there is no better time to perform the operation than when the calf is two weeks old. The horn at this age is merely a section of soft, hairless skin called the matrix, or mother of the future horn. In removing it, it is only necessary to make clean work of it, taking a rim of the skin an eighth of an inch wide surrounding the matrix. It can be done with one firm sweep of the knife, the calf being laid upon its side, and the head held firmly to the ground under the knee of the operator.—*N. E. Farmer.*

Glanders and Farcy.

The Tennessee State Board of Health in its bulletin for March commends the health officer of Nashville for his prompt destruction of three animals affected with glanders.

The board calls the attention of other local authorities to the importance of the immediate destruction of all animals affected with the disease. Glanders and farcy are two names denoting really one disease, due to the same specific poison. It is called glanders when the air passages are affected, and farcy when the skin, areolar tissue, lymphatics, and glands are most prominently involved. Damp, ill-ventilated, narrow, and ill-built stables, insufficient or unwholesome food and excessive fatigue are the principal predisposing causes to the development and propagation of the disease. It invariably terminates in death, whether it appears in the acute or chronic form. Its communicability from one horse to another, from the horse to man, and from man to man, is now no longer questioned; hence health officers should act with great promptness in every case, rigidly enforcing isolation in regard to all "suspects" and extermination of all animals known to be affected.

The German law directs that any horse which has been *even in contact* with a glandered animal shall be *immediately* killed. This is wise. When the horse is killed, it should *at once* be buried deep in plenty of lime, and its former habitation thoroughly disinfected, first with sulphurous acid fumes, followed by prolonged free ventilation. All tainted food, bedding, etc., should be speedily burned.

The Largest Coal Breaker.

The Kingston Coal Company has erected the largest breaker in the anthracite coal regions at Edwardsville, Pa. The time occupied in its construction was a little over one year, and about 2,000,000 feet of pine and hemlock lumber have been used to build it. The structure is about 380 feet long and 100 feet wide at the widest point. Five pairs of rollers, 15 screens, and two friction gears, a stationary engine 20 by 36, two pairs of hoisting engines, besides a large amount of other machinery, will be used in the breaker. The capacity of the breaker will be over 1,000 cars of coal per day. The culm will be drawn from the breaker on a trestling, by means of an engine, and no mules will be used there. All the most improved machinery has been put in, and the result is that less men can do the usual work than in other breakers.

Notes from Patent Decisions.

A mistake in an expression, proved to be so by other parts of the specification, will not vitiate a patent.—Judge Nixon, Reed *vs.* Street.

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ENGINEERING INVENTIONS.

A track lifter has been patented by Mr. James W. McDonald, of Winnipeg, Manitoba, Canada. The invention consists of one or more jacks attached to a plank and operated by levers, a device for raising the plank and jacks, and an automatic grip, all mounted on a hand car, and adapted for raising railroad tracks in repairing and constructing.

A boiler or tube covering has been patented by Mr. William M. Suhr, of New York city. It consists of a shell with solid annular strips resting on the boiler or tube, covered and placed a suitable distance apart from each other to form separate closed annular air spaces between the boiler or tube covered, the shell, and the strips.

A car coupling has been patented by Mr. John L. Setty, of North Uniontown, O. The invention consists of a sliding plate moved forward to come beneath the point of the coupling pin by the action of the lever employed to raise the pin, with other novel details, designed to make an automatic coupling, and one which may be used with other couplers.

A car coupling has been patented by Mr. Alexander H. Stephens, of Thompson's Station, Tenn. It is so constructed that an approaching link will strike a trip projection and adjust a grapple parallel with the drawbar, which latter is pushed back until held by a detent, with other details, whereby an automatic coupling and uncoupling of parts is effected without involving the necessity of the operator going between the cars.

A railway signal has been patented by Messrs. Clement P. Willshaw, of Brooklyn, N. Y., and Alexander Willshaw, of New York city. A shaft that operates a gong striking mechanism is so constructed as to automatically assume a position for striking the gong, in case the switch operating connections are broken or get out of position or release the switch, the signal being adapted to be sounded by passing trains.

A tunneling machine has been patented by Mr. Frank O. Brown, of New York city. It is a shell of plate iron bolted together, its forward end beveled with longest side upward, having an airtight transverse partition with man holes and pierced by a conveyer tube with spiral flange projecting beyond its forward end, with other novel features, whereby the machine can be forced forward through the ground and allow brickwork to be readily laid.

MISCELLANEOUS INVENTIONS.

A lining for refrigerators has been patented by Mr. John S. Fairly, of Charleston, S. C. The invention consists in the use of an insulating filling consisting of cottonseed hulls, and the making of a refrigerating package with such filling.

A wind wheel toy has been patented by Mr. Frank G. Gollon, of Hoboken, N. J. It is a device of tube in place of the stick on which a child's pin wheel is usually held, so arranged that the wheel may be revolved by blowing in the tube.

A mechanical toy for children has been patented by Mr. Peter J. Owens, of New York city. It consists of a rectangular oscillating tray mounted at a suitable incline upon a stand or support, with hinged strips, so that a ball starting from the bottom may be made to ascend to the top of the tray, when it will reach a return channel to conduct it again to the bottom.

A plumb level has been patented by Mr. Michael S. Weller, of Charlestown, W. Va. Combined with an index and pivot shaft is a tubular bearing having a glass lining, the device being an improvement on carpenters' levels where the spirit bulb is more commonly employed.

A music leaf turner has been patented by Mr. Louis L. White, of Portland, Oregon. It has a shaft, cogwheel, and a series of pinions carrying each a rod, a paper holding clip, and other features, making a convenient device for turning the leaves of sheet music rapidly and perfectly.

A ruling machine has been patented by Mr. James W. Dickieson, of Brooklyn, N. Y. It is for producing diagonal lines at any desired inclination over the usual ruling, to effect which the invention covers a construction involving a novel combination of parts and details.

A wagon box brace has been patented by Mr. Matt. F. Allen, of Nashville, Tenn. It is a double legged strap brace, with its legs perforated to receive fastening bolts or screws, so made as to hold the sides and bottom of the box more firmly together, to keep them straight, and prevent the timber from warping.

A syringe attachment for bottles has been patented by Mr. Anaximander B. Tutton, of Sioux Falls, Dakota Ter. It is so made that when not in use a rubber cap covers the bottle, the tube and nozzle being sheathed therein, while the device furnishes a syringe and stopper for bottles or vials of any size.

A dry closet has been patented by Mr. George F. McMurry, of Eureka Springs, Ark. It is made of strong tin, sheet iron, or zinc, but light enough to be conveniently carried from room to room, and has some novel features, making it especially applicable for use in hospitals, prisons, and private dwellings.

A trunk lock hasp has been patented by Mr. William H. Plant, of Brooklyn, N. Y. It is of novel construction to the end that hasps so made will accommodate themselves to the shrinkage of the trunks, and allow their hooks to be readily inserted in the aperture of the lock, while being strong and durable.

A wagon axle nut has been patented by Mr. Frank O. Slanker, of Pomona, Cal. It has a gravitating dog eccentrically pivoted to the axle arm, to engage the interior of the wheel retaining nut, thus providing a simple and inexpensive device whereby the unscrewing and loss of the nut will be prevented.

A school desk has been patented by Mr. Joseph A. Wilson, of Hood River, Oregon. It has a novel combination of parts for holding the cover raised and for clamping a book or drawing thereto, at any desired angle, for more convenient use in reading, writing, drawing, etc.

A folding baby carriage has been patented by Mr. Charles Haller, of New York city. This invention covers various novel details of construction whereby a baby carriage so made can be completely folded, to be readily taken in and out of houses and up and down stairways, and be stored in a comparatively small space.

An ice planing and ridging machine has been patented by Mr. Stephen L. Smith, of St. Louis, Mo. It is for planing the snow and soft ice from the tops of ice blocks, and ridging the top faces so the blocks will not freeze together, being an improvement on a machine for this purpose formerly patented by the same inventor.

Artificial fruit making forms the subject of a patent issued to Marie Ginoris, of New York city. The process consists in forming a mould of the fruit to be imitated, covering the surface with cloth wet with cement, drying and removing the cloths and cementing together their edges with wire stem inserted, and painting the body.

A rein ring has been patented by Mr. Julius C. Hobbs, of Hobton, N. C. It consists of a grooved wheel or roller mounted in bearings formed in a frame of peculiar and novel construction, in which the line or rein may be readily inserted, when it will be prevented from being chafed, fretted, or worn by being rubbed.

Paper making devices form the subject of a patent issued to Messrs. Frederick W. Miller and John J. Newman, of Elkhart, Ind. They are to be made a part of a paper machine for applying paraffine, wax, or other substances to and incorporating them into and through a web of paper during the making and finishing, to make it waterproof, etc.

A bark mill has been patented by Mr. Benedict Ott, of La Crosse, Wis. It is of that class in which the bark is rapidly revolved by a carrier operating within a cylinder with radial openings and cutters, and it is made with sectional cylinders, so one can be repaired while the other is in use, and the mill thus practically run all the time.

A riding saddle has been patented by Mr. John W. Newman, of Decatur, Tex. This invention relates to devices intended for use in coupling or connecting girths to saddles where it is desirable to quickly adjust the saddle, as in stock countries, in case of a stampede of cattle, providing an efficient and economical construction therefor.

A truss has been patented by Messrs. Edward Williams, Jr., and Ralph M. Lashell, of Centralia, Pa. It consists of a rod or wire curved to encircle the body, having at the back two eyes carrying pads, with an adjusting strap and buckle, and at the front two or more loops inclosed by the truss pad, being designed as an efficient but inexpensive device.

A domestic hand press has been patented by Mr. John W. Condon, of Logansport, Ind. It is designed to facilitate pressing fruits, making jellies, etc., and has a base plate with vertical overhanging standard carrying a screw shaft which bears upon a platen to fit inside a perforated chamber, the parts being readily detachable for easy cleansing.

A self-fastening skate has been patented by Messrs. Eugene M. Florentin and Albert T. Falvey, of Taunton, Mass. The skate stock is a metal plate with a curved flange on its rear end, and clasps on its forward part which slide in keepers and are held apart by a spiral spring, with other novel features, whereby the skate will fasten itself to the shoe as soon as put on.

A plumber's trap has been patented by Mr. Frederick S. Gerstenberg, of Astoria, N. Y. It is a D-trap, open at one side, with a rabbet around the edge of its open side, a horizontal valve and weighted bell crank lever, to close the valve when there is little or no pressure of water, and so arranged that any pressure of sewer gas will tend to close the valve more firmly.

A machine for separating flaxseed has been patented by Mr. Jeremiah Bates, of Sherburne, Minn. It has a vibrating box with inclined sieve, the lower end forming a spout, a partition extending in an inclined direction reverse to that of the sieve, another partition extending under the sieve, and other novel features, for separating flaxseed according to its size.

An explosive compound has been patented by Mr. Max Bielefeldt, of Kalk, near Cologne, Germany. It consists of nitro-cellulose in a solution of nitrate of ammonia in water of ammonia, or of nitro-glycerine and nitro-cellulose with nitrate of ammonia in water of ammonia, prepared after a special manner and with varying proportions for differences of explosive force.

A fire arm has been patented by Mr. Salvatore J. Buzzini, of New York city. It has novel means for securing the barrel in its place, and for its ready detachment and replacement, and for a more accurate return of the barrel to its normal position than is practicable when the barrel is secured to its place by screwing it into the stock, without having recourse to a gunsmith or other skilled artisan.

A lamp extinguisher has been patented by Mr. Jacob Philippi, of New York city. The construction is such that when the wick is turned down, a weight causes a plate to swing over the upper end of the wick tube, and the flame will be immediately extinguished, with other novel features, the invention being an improvement on a former patented invention of the same inventor.

A baker's oven has been patented by Mr. Solomon M. Raines, of Logansport, Ind. The grate is on a level with the bottom of the oven, a wall projecting upward between the bottom and the grate, and the vent pipe extends from directly over the grate to the outside of the oven, and thence across to the chimney, making an oven that is simple in construction and bakes rapidly.

A star time chart has been patented by Mr. Joseph B. Morse, of Brandon, Vt. It is a pivoted disk divided by radial lines into twelve equal spaces representing the months of the year, the twelve spaces being divided to form twenty-four spaces for the hours of the day, with a movable index, pointer, etc., for determining mean time by an observation of one of the circumpolar constellations and the pole star.

A band cutter and distributer for thrashing machines has been patented by Messrs. Benjamin F. Applegate and Benjamin F. Lagel, of New Albany, Ind. The feed board of the machine has a feeding chute with sloping bottom, and rotary band cutters extend across the chute, slotted spring guards being arranged over each cutter, on which guards the attendant places the bundles, so the bands will be cut, and at the same time pushes the bundles along the chute to the thrashing cylinder.

NEW BOOKS AND PUBLICATIONS.

KROEH'S DRILL BOOKS. III. The Pronunciation of French. IV. The French Verb. By Professor Charles F. Kroeh, Stevens Institute of Technology. Hoboken: Published by the author.

The French student is at present offered the choice of two methods—the conversational, in which he acquires a knowledge of the language simply by practice, or the grammatical, in which he devotes himself to the rules and structural part before attempting to converse. Both methods have their advocates. It depends largely upon the age and mental habits of the student which would be the more suitable, but it seems to us that a mixture of the two is the true method. We therefore find much to commend in Professor Kroeh's drill books, for he has endeavored to combine the ready facility of the one with the precision of the other. It is too often the case that the conjugation of the verbs is memorized as a whole, and the student finds it impossible to employ the proper person and tense when isolated, without an awkward pause. It is a distinguishing feature of these little text books that the idea is always inseparable from the words. To accomplish this, the verbs are taught by persons instead of tenses, which we can easily imagine will produce happier results than the older method of tabular instruction. The study in pronunciation will be found equally practicable.

INSECTS AFFECTING THE ORANGE. By H. G. Hubbard. With plates and wood cuts. Washington: Government Printing Office. 1885.

For nearly four years Mr. Hubbard has devoted his time to the study of the insects affecting the orange tree, and has given particular attention to practical experiments for counteracting their injuries. The trees belonging to the Citrus family are specially subject to the attack of insect pests, and so extensive are their ravages that it has been stated there are absolutely no orange trees in the whole State of Florida which are entirely free from their presence. The present report is a special one ordered by Congress, and has been prepared with the sole purpose of affording a practical guide to orange growers. While it is based almost entirely upon observations made in Florida, this being our largest orange-growing State, much of the information will be equally applicable to other districts undertaking the culture of the fruit. The work also contains several handsome colored plates and numerous wood cuts. Those desiring copies of the report should address the Commissioner of Agriculture, Washington, D. C.

THE SUBURBAN COTTAGE: ITS DESIGN AND CONSTRUCTION. By W. B. Tuthill. New York: William T. Comstock.

This is a brief treatise, intended to lay before the student the process of systematic design, and at the same time treat of elementary details in construction and finish. The scope of the volume is not a very wide one, but those who have the designing and building of summer houses will find here some important suggestions, and the author's views are set forth with great clearness.

THE NEW AGRICULTURE; OR, THE WATERS LED CAPTIVE. By A. N. Cole. New York: *The American Angler*.

The author describes in this volume a success which seems almost wonderful in overcoming the sterility of a forbidding location, and making his "home on the hillside," in Allegany County, N. Y., one of the most productive spots anywhere to be found. He has done this by a system of underground irrigation, which he has patented, whereby the natural length of the season is prolonged from forty to sixty days, the crop yield of everything grown is greatly increased, and the quality correspondingly improved.

FOOD MATERIALS AND THEIR ADULTERATIONS. By Ellen H. Richards. Boston: Estes & Lauriat.

The author is an instructor in sanitary chemistry in the Massachusetts Institute of Technology, and although this little volume is altogether too small for much of a statement of the subject, all that is here given is valuable, and presented in a plain and sensible manner.

Alpine Winter in its Medical Aspects is the title of an attractive pamphlet by Dr. A. Tucker Wise, touching the curative and health-giving properties of the air and springs of that locality for various kinds of invalids, the whole being written with especial reference to the facilities afforded in this way by the Hotel Kursaal de la Maloja.

A Directory of the Tanning and Boot and Shoe Trades, and the branches collateral thereto, forms a convenient and what would seem to be a specially useful volume to all connected with such business which has recently been issued from the press of the *Shoe and Leather Reporter*, New York city. It embraces the United States and Canada, together with the most prominent foreign houses.

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Curtis Pressure Regulator and Steam Trap. See p. 142.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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Barrel, Keg, Hogshead, StaveMach'y. See adv. p. 76.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 238.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) M. W. writes: 1. I have not met with success in bleaching dark nettle-tree wood (Celtis australis), by using muriatic acid and water or calcium chloride, etc., at 3 to 4 atmospheres pressure. How can I bleach this dark wood? A. Saturate the wood as completely as possible with a clear solution of 17¾ ounces chloride of lime and 2 ounces soda crystals in 10½ pints water. In this liquid the wood is steeped for half an hour, if it does not appear to injure its texture. After this bleaching, it is immersed in a solution of sulphurous acid to remove all traces of chlorine, and then washed in pure water. The sulphurous acid, which may cling to the wood in spite of washing, does not appear to injure it, nor alter the colors which are applied. 2. What kind of cement is used by the ferule makers for brass and copper ferules to put on walking canes and whip sticks? How are they soldered? A. As a general thing, no cement is used, but you can use glue or shellac. See also "Cements," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158.

(2) E. S. F.—The force required to overcome gravity on an inclined plane=weight×height÷length. Thus an 800 ton schooner on a marine railway with an incline of 10 feet in 100 feet will require 80 tons force to overcome gravity, to which must be added the friction of the rollers. We do not apprehend the manner of pulley application you speak of, but suppose you have a leverage of 1 to 100 on the combination, which will make the force on the last turn of the rope about 1½ tons including friction.

(3) J. W. P. asks: What is meant by first, second, etc., dilutions, in homœopathy? A. The first dilution consists of one grain of the crude drug triturated with nine of milk sugar or dissolved in nine drops of alcohol. It is also called the first decimal attenuation. The second dilution or first centesimal dilution is one part of the drug mixed with 99 of the milk sugar or alcohol.

(4) T. W. S.—An excellent plan to polish brass consists in using oxalic acid and whiting mixed and applied wet, with brush, and brushed again when dry with soft plate brush, to polish with dry whiting. The oxalic acid removes the dirt and the whiting does the polishing.

(5) J. B. J. asks (1) the method used by engineers to determine whether the steam from a boiler is wet, saturated, or superheated. A. A dry cloth held in a jet of dry steam will not become moistened, or but very slightly; in wet steam it will soon become saturated. A moist cloth held in a jet of superheated steam will become dry. All these methods in which a jet of steam is tested are imperfect, because the air alters the condition of the steam. 2. How to determine the percentage of water in steam? A. By passing it through a condenser maintained at its own temperature, and collecting and weighing the water that accumulates. The steam that has passed must be separately condensed and its weight determined. 3. How many heat units in a pound of hydrogen? A. One pound of hydrogen in its combustion will raise the temperature of 34,000 pounds of water one degree Centigrade or one and four-fifths degrees Fahrenheit.

(6) K. J. asks: 1. What is the opposite adjective of slippery? A. Sticky, adhesive. 2. Does the increased size of an animal or a person increase the sensibility of pain? A. It does not as far as we know. 3. Why does a person see sparks or flashes of light in the eyes when the head is struck or receives a sharp blow? A. Professor J. G. McKendrick, of Glasgow University, says: "A luminous sensation may be excited by various modes of irritation of the retina or optic nerve. Pressure, cutting, or electrical shocks may act as stiumuli, but the normal excitation is the influence of light on the retina." It is generally believed that it is the filaments of the optic nerves, and not the retina, that receive the effects of these abnormal disturbances.

(7) J. A. R. asks: What can I use for ink to print with a rubber stamp on hard wood and make it indelible, or so much so that by occasional washing it will not be easily effaced? A. We would recommend printer's ink, thinned down with turpentine.

(8) J. W. P.—Lozenges consist principally of powdered sugar, made into a mass with some glutinous liquid, such as gum arabic, thin isinglass size, etc., without the aid of heat, and dried. The lozenges mentioned by you are probably similar, and flavored with extract of wild cherry.

(9) J. D. asks: 1. To mix Venetian red paint with oil, what measure or weight of dry color should be used to the gallon of oil, to give the best satisfaction on weather-beaten boards of barns? Should the first and second coats be mixed the same? A. The proportions are about seven pounds of the dry color to six pounds of oil. The two coats are generally the same. 2. To reburnish a Darlot photo lens. A. The reburnishing of the lens will be a difficult operation, in the same way as the original grinding and burnishing. 3. Also to reblack the same inside. A. Use gum water and lampblack.

(10) F. S. W.—To clean marble, mix quicklime with strong lye, so as to form a mixture having the consistency of cream, and apply immediately with a brush. Let this composition be allowed to remain on a day or two and be then washed off with soap and water.

(11) T. E. writes: We have an exhaust fan belted direct from engine, and when run to high speed the belt flaps badly. Would a fly wheel set in same shaft as fan prevent the flapping? A. The flap in the belt may be due to the irregular motion of the engine, in which case a fly wheel could be better applied to the engine; or, if the engine has a small sized fly wheel, make one very much larger in diameter, but not necessarily heavier. It is the large diameter in a fly wheel that gives regularity of motion. We would not recommend a fly wheel on the fan until you are satisfied that the fan is at fault.

(12) J. K. B. asks a rule for finding strength or size of wrought iron sheets in water tanks or standpipes, say when diameter or area is given, and height or depth of water to be carried. For instance, thickness of plates needed for wrought iron tower, 25 feet diameter and 125 feet high. A. For the strength of the different sections of a water tower or stand pipe, proceed as in the case for the safe strength for boilers under various pressures, adding a requirement for supporting extra high towers. Thus you would have a hydrostatic pressure at the bottom of your tower equal to 53 pounds per square inch. You should provide for stability or safety, wear and tear by oxidation, and loss of strength by riveting, at least four times the above strain, or say 200 pounds, which, multiplied by the diameter in inches=300×200=60,000 pounds tension on each vertical inch of iron forming the sides at the bottom. As plate iron cannot be trusted over 45,000 pounds tensile strain, you will require not less than 1¼ inches for the above allowed strain. This, divided by 2 for the two sides, calls for the lower sheets to be ⅝ inch thick, say for 30 feet, ⁹⁄₁₆ inch for the next 30 feet, ½ inch for the next, ⁷⁄₁₆ inch for the next 30 feet, ⅜ inch for the next 20 feet, and ¼ inch for the last 15 feet. This will make a substantial tower for a lifetime.

(13) E. R. S. asks the best method of tempering an anvil. I have tried it once, and I cannot get it hard enough. I used a hardening compound, but it seemed not to affect it. A. We know of nothing better than giving the anvil a full cherry red heat and dipping sidewise, so that the bubbles of steam will clear the surface. It is the steam hanging on the under surface that prevents hardening.

(14) A. P. H.—Hard wood floors may be finished with beeswax or paraffine by rubbing the wax over the floor and burnishing it down with a leather pad. Floors are painted with various colors. Prince's metallic paint is a red oxide of iron, and is mixed with boiled linseed oil. It will make the floor red. Chrome yellow with a little Prince's metallic paint make a bright orange much in vogue for country houses. You will require no license for your boat on waters that are not commercial highways.

(15) Gyp.—Will you please inform me, by your paper, what gold is worth a carat, also the worth of fine sterling and coin silver, and the amount of alloy used in reducing both fine and sterling to coin? A. Gold is worth per ounce $20.67183; per carat in ounce, $\frac{1}{24}$ of this sum. Silver varies in price continually. Coin silver and gold of this country contain $\frac{9}{10}$ of the pure metal. Silver 999 fine is worth about $1.02 per ounce. Sterling gold or English coin gold contains 1½ gold, $\frac{1}{12}$ alloy. Sterling silver or English coin silver contains 222 silver to 18 of copper. The values of the different alloys can be calculated from the above figures.

(16) O. A. asks: Why is the sun marked in our almanacs "fast" from April 15 to June 15 and from September 1 to December 25, and "slow" the remainder of the year, while the angle passed over by the radius vector is greatest January 1 and least July 1? A. The phenomenon of the fast and slow sun arises from two causes, viz., the unequal motion of the earth in its elliptic orbit and the obliquity of the ecliptic, which latter gives much the largest element in the variation of the sun's apparent motion. See Newcomb's and Holden's Astronomy.

(17) W. H. B. asks: 1. What will prevent worms from eating hickory handles? A. Most solutions adapted for this use are somewhat poisonous, and hence not adapted to handles. Creosoting or immersion in hot solution of carbolic acid with some pressure after thorough kiln drying would seem safe, and would be effectual provided it did not deteriorate the fiber of the wood. Linseed oil is recommended. See SCIENTIFIC AMERICAN, May 8, 1886, p. 289. 2. Will steaming them prevent it? A. Steaming will not prevent it, but will kill any that have begun operations.

(18) W. M. B. asks: 1. Can a quantity of well ground apples, occupying the space of 3 by 4 feet by 2½ or 3 inches thick, be pressed dry in half a minute? If so, what is the weight required? A. Cider presses cannot be worked quickly. It takes time for the apple juice to work out. The whole pressure should not be put on at once. 2. Can wood be finished to imitate marble? A. To some extent. 3. How are gun barrels flowered and lettered with silver and gold? A. Inlaying in gold and silver on gun barrels is done by etching the design with acid and undercutting the edges with a graver, then hammering the soft gold or silver into the design and dressing the surface with file and polisher.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

C. H. G.—The sample is an ocher or clay containing iron. It might be of value as a paint if burnt and ground in oil. In its present condition it is of no use; it lacks body, although apparently free from grit.—R. W. S.—The sample of clay sent is altogether too small to form any sort of an estimate concerning its value. As it is somewhat gritty, it can scarcely be used for anything except common purposes. If it will stand heat, it might be used in the manufacture of fireclay bricks.—F. M. B.—The specimen is syenite, similar in composition to the obelisk in Central Park, and consists of the minerals feldspar, hornblende, and quartz. It is of no value.

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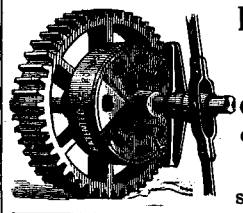

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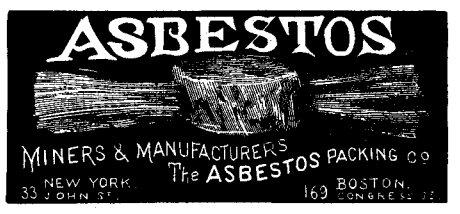

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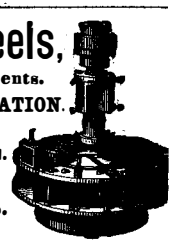

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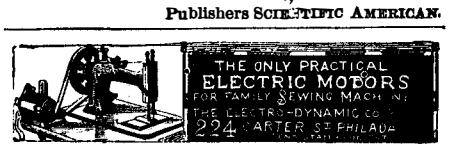

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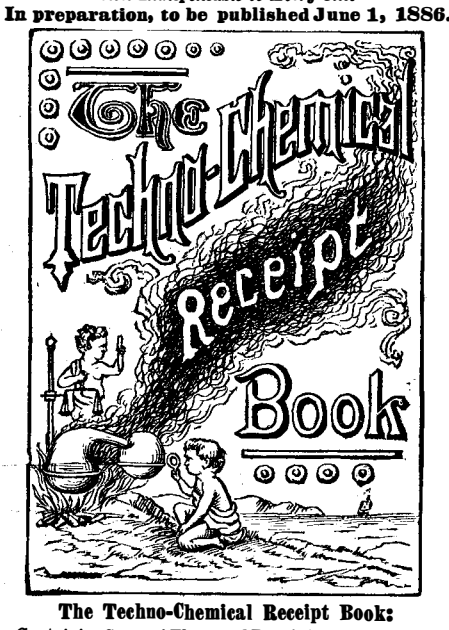

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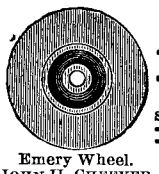

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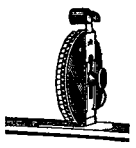

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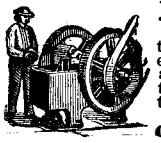

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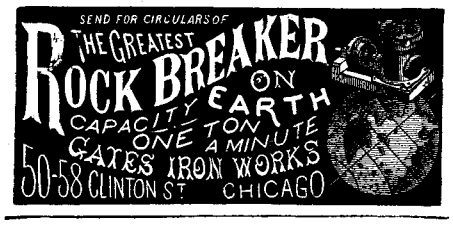

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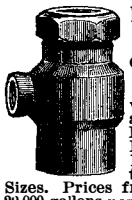

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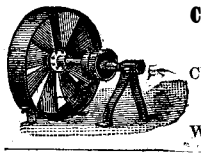

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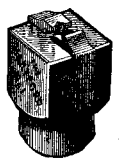

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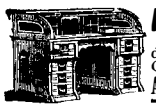

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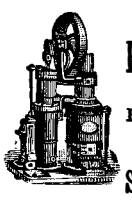

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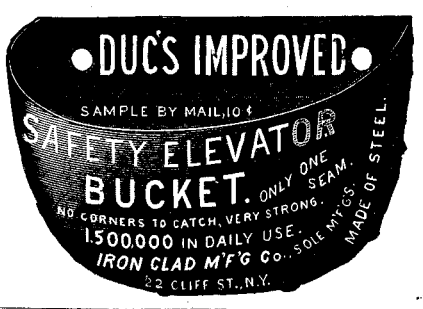

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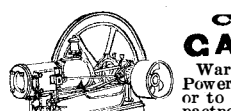

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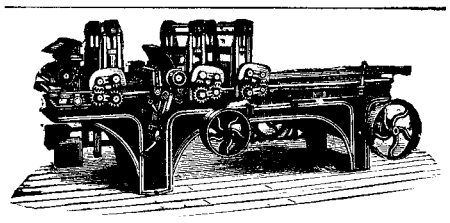

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